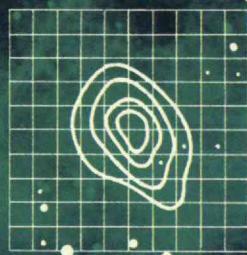


Technology Review

Edited at the Massachusetts Institute of Technology

March, 1967



Radio Astronomy Today

Molecular Biology and Man, page 16

technology review

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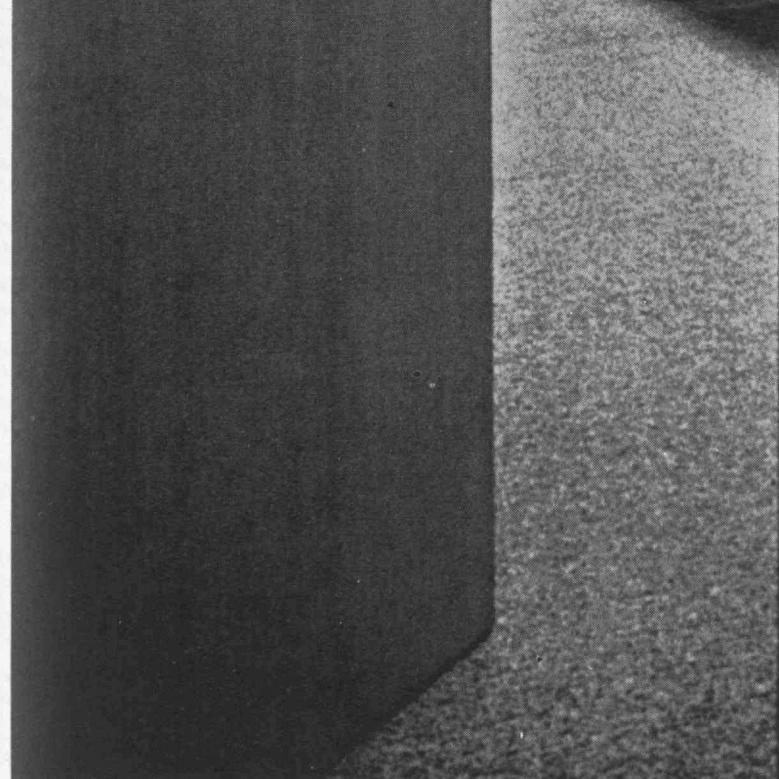
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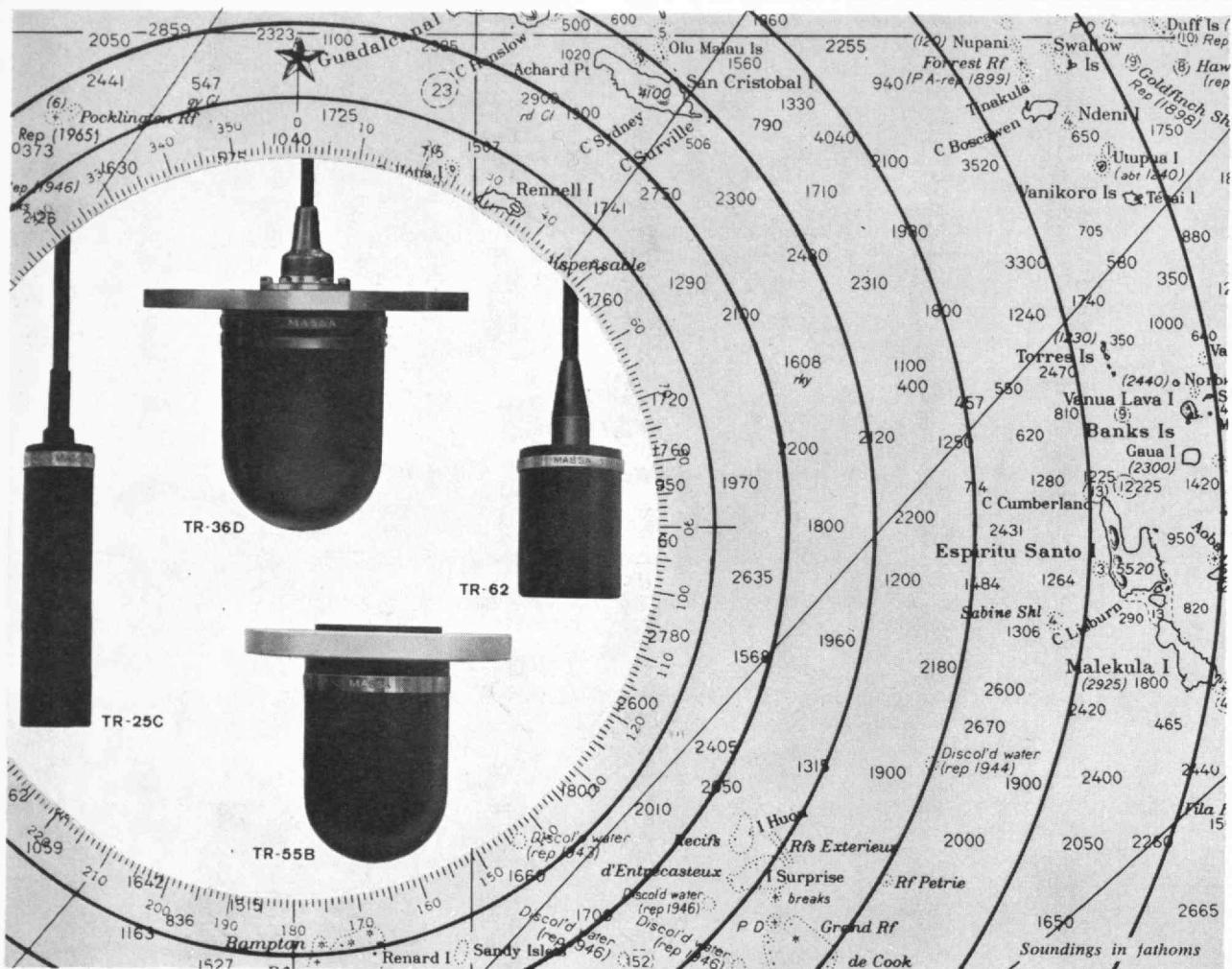


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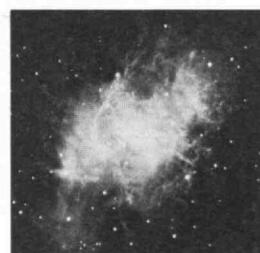
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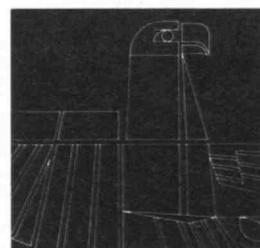
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The cover: The March cover shows two views of the Crab Nebula, one of the most impressive objects in the night sky. Superimposed on the photograph (by William C. Miller, Mt. Wilson and Palomar Observatories, © California Institute of Technology) is a typical radio energy contour (not to scale). James W. Meyer discusses the development of radio astronomy beginning on page 36.



Next month: For April, Technology Review announces a special supplement on the increasing role of the Federal government in higher education, science, and M.I.T., with papers by Daniel S. Greenberg, Max F. Millikan, and Jerome B. Wiesner. Regular features will include reports on science and architecture at Expo '67, the great world exposition opening in Montreal on April 28.



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Review on Science

How Much Danger in Space?

By Robert C. Cowen, '49

The tragic loss of the three Apollo astronauts focused attention on the question of safety in space flight. But if you try to assess that question from what you read in the press or see and hear on television and radio, you should be wary.

Many reporters and commentators have presented the dangers of space flight in far starker terms than is justified by anything we know so far.

For half a decade, the "inevitability" of disaster has been stressed. Malfunctions and other problems of the Mercury and Gemini flights were often seized upon as signs of extraordinary risk. When Colonel Virgil I. Grissom, Lieutenant Colonel Edward H. White, 2d, and Lieutenant Commander Roger B. Chaffee died in a flash fire in their Apollo 204 spacecraft January 28, many reports made the point that the "inevitable" had finally happened.

Obviously, the astronauts are in a dangerous profession. But it is not a profession which is disaster-prone or, to judge from experience to date, in which men are running an unusual degree of risk. In fact, as applied to space flight, the term risk has a vague meaning. Insurance actuaries calculate the risk of driving a car down to the last penny of your insurance premium. From accident statistics, they know the probability of certain types of accidents occurring in specific areas for given periods of time. There isn't an actuary who can calculate the risk of space flight. We have had far too little experience with space for such an assessment to be made in statistically meaningful terms.

So far, we have lost six astronauts. Three have died in aircraft accidents. Now three have died during a ground test of their spacecraft. All of the astronauts who have gone into space have returned safely and in good health. The disaster at Launch Complex 34 was akin to the helicopter crash during a routine flight in California that shared the newscast with the first report of the Apollo 204 fire. That fire was due to equipment malfunction, human error, or both. The cause was not known at this writing. But it had nothing to do with the "hostile environment of space."

It would be foolish to discount the possible dangers of space flight. It is equally illogical to think that some astronauts must sooner or later become their victim when no one knows how

well men will cope with them. Astronauts face the same risks as test pilots in working with novel equipment in new flight regimes. On top of this, they face the uncertainties of space. How will equipment stand up to weightlessness and, where exposed, to the high vacuum and temperature extremes of space? How will the human system adapt to space flight? Are there hazards not yet foreseen?

The most you can say in dealing with such ill-defined danger is that we must proceed with caution. And this is just what NASA has done.

The situation is like that of the atomic energy industry in its early years. Here too, men faced ill-defined and possibly extraordinary hazards. They met the challenge by paying extraordinary attention to detail, by making safety a top-priority objective. The result has been the growth of a major industry with one of the lowest accident rates of any big enterprise. Likewise, by extreme care in design, manufacture, and testing of equipment and in selection and training of personnel, NASA has maintained a low accident rate in manned space flight.

This aspect of the safety story has been poorly reported in the public media. I am saying this from the viewpoint of a science writer who has handled news copy on all of the American space flights and who has covered nine of them personally. On every one, dangers to the astronauts and the operational difficulties they encountered have been exaggerated in many news reports. This has run the gamut from outright fabrication of stories to misinterpretation of official statements. Here are a few examples.

During one of the Mercury launches, the diesel engine that pulled back the gantry would not start up for awhile. This delayed the launch. A reporter near me began speculating that Cubans had sabotaged the engine by putting sugar in the diesel fuel. Yes, I know it was stupid. But he was serious. What was more incredible, his speculation was sent out in radio newscasts!

Then there was the trouble with low pressure in the Gemini 5 fuel cells. It arose soon after launch. There was a question for awhile of whether or not to continue the mission. But no NASA official or fuel-cell expert available forecast termination. Yet some commentators assured their audiences that the flight was probably a failure.

As you know, Gemini 5 remained in orbit eight days to set a record for endurance. Along the way, there were other equipment troubles. There were questions about hoarseness in an astronaut's voice. All these things were minor in the perspective of the continuing operation of the flight. Yet re-

peatedly newspaper or radio/TV reports said how bad things looked as each new problem appeared.

Then, at the end of the generally successful flight, someone asked Flight Director Christopher C. Kraft if he considered the spacecraft a lemon because of equipment troubles. Mr. Kraft was understandably indignant. The question typifies the outlook of some of the newsmen who can't distinguish between problems with flight-test equipment and over-all mission success. They also can't tell the difference between emergencies with which astronauts can cope and real danger to astronaut safety.

Probably the most scary episode in orbit was the misfiring of a Gemini 8 thruster which terminated its flight. Yet even here NASA care paid off. Quick action by astronauts and ground teams stopped the spinning of the craft and brought it to a landing near an emergency recovery ship.

Stupidly, NASA at first withheld the astronaut voice tapes. A rumor started that the voices showed panic. When the tapes were finally played, the voices, while tense, reflected calm competence. Yet the unfounded suspicion that the astronauts panicked persists.

Over the years, this sort of thing has built up a conviction among some reporters that there are dangers in space flight beyond anything that NASA will admit. This is partly due to the unfamiliarity with technical problems you would expect in a general news reporter. It is also partly due to suspicions that NASA officials do not always tell the whole truth. While there are grounds for this suspicion, it has often unbalanced a reporter's judgment in the question of safety and equipment malfunction.

Then there is the constant expectation of disaster with which some reporters view the space flights. As the novelty of orbital flight wore off, a number of newsmen told me their main reason for covering the flights was the possibility of disaster. One major foreign wire service, according to its representative, was only interested in this aspect of the later Gemini flights. In fact, he felt pressured to play up any possibility of trouble.

By and large, the news coverage of our space-flight program has been good. But on the subject of safety it has fallen down. Individually, many reporters and commentators have tried to put the safety story into correct perspective. Yet, judging from the news operation at Houston and Cape Kennedy and from what was printed and broadcast, the public has been given the impression there is more specific danger to astronauts than the facts warrant.

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says Thomas L. Thorkelson, C.L.U., Santa Ana, California



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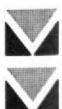
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Review on Books

For the Price of Two Bushels of Wheat

By Joseph Mindel

In March, 1840, 12,000 Bostonians applied for tickets to attend a series of lectures on botany offered by the newly established Lowell Institute. Since the Odeon Theater, where the lectures were to be given, seated only 2,000, tickets were distributed by drawing lots. People arrived early to get the good seats, bringing books, knitting, and sewing to pass the time.

A century and a quarter later what event could attract 12,000 citizens of Boston? A professional hockey game? The Beatles?

Is the contrast a symbol of decline? "Oh, what a fall was there, my countrymen!"

In *The Lowells and Their Institute* (Atlantic-Little Brown, Boston, 1966, 202 pp., \$5.75) Edward Weeks, former editor of the *Atlantic Monthly*, invokes the Puritan heritage and the meetinghouse to explain the early popularity of the lecture. The first prohibited or discouraged theatrical performances; the oratory and disputation of the second provided the emotional outlet of drama. The Lowell Institute, growing out of this background, has not only survived the passing of eras but has helped to shape their cultural life.

John Lowell, Jr., who died in 1836, bequeathed \$250,000 to the founding of an institute whose major function was to present a series of public lecture courses for adult audiences. His will contained several unusual provisions. There was to be only one trustee, who was empowered to name his successor. Ten per cent of the interest on the capital was to be reinvested each year; through astute management, the original sum has increased steadily to a market value in 1966 of \$8,000,000. The money was to be used not for buildings, but to secure outstanding authorities, not popular speakers, to give the lectures.

There have been four Trustees, all Lowells. Mr. Weeks presents brief but illuminating portraits of the Trustees, describing how each met, inevitably in terms of his own tastes, what he considered to be the needs of his time. All, however, maintained the quality of the lectures by bringing to the platform the best qualified lecturers.

In the early years, these included Charles Lyell on geology, Louis Agassiz on comparative embryology, Jared

Sparks on American history, James Russell Lowell on English poetry, and Mark Hopkins on theology. Among more recent speakers have been Theodore Roosevelt, Justice Oliver Wendell Holmes, William James, Bernard de Voto, and McGeorge Bundy. Attendance began to fall off at the beginning of the Twentieth Century. By the 1950's, audiences rarely numbered more than 90, although in 1960, George F. Kennan's series on *Russia and the West* filled Sanders Theater and an overflow hall as well.

While the lecture courses were of primary concern, John Lowell's bequest also suggested that practical courses might be provided for artisans at a minimal charge, the equivalent of "the price of two bushels of wheat." A surprising number of activities, of which Mr. Weeks gives detailed accounts, have been based on this provision of the will. In the last 100 years, there have been a drawing school, unique in that pupils were required to draw from objects in the round, never from flat copies; a School of Practical Design; evening collegiate courses conducted by M.I.T. professors; a Teachers School of Science; and courses in law at the Y.M.C.A., an infant law school, from which, according to Mr. Weeks, Northeastern grew.

Practical courses for artisans took the form of the School for Industrial Foremen, a two-year technical program of free courses at M.I.T. Under A. Lawrence Lowell, the name was changed to its present form, the Lowell Institute School. He also established the University Extension system at Harvard (later extended to include neighboring colleges), the cost of which was borne by the Lowell Institute, while students paid a fee of \$5 per semester, the price of two bushels of wheat.

The act incorporating the Massachusetts Institute of Technology in 1861 carried the stipulation that a guarantee fund of \$100,000 be raised within one year. There is a legend, Mr. Weeks reports, that the first Trustee of the Lowell Institute, John Amory Lowell, made a substantial contribution out of his own pocket. It is a matter of record that the Lowell Institute provided financial assistance by paying for a series of free courses at the new institution of higher learning, as well as by renting its new auditorium for the Lowell public lectures. When William Barton Rogers was elected president of M.I.T., John Amory Lowell was the first of four vice-presidents.

The second Trustee, Augustus, was a member of the M.I.T. Corporation and deeply involved in its affairs. Largely for this reason, he was not invited to serve on the Harvard Corpora-

tion as had three generations of Lowells before him. His successor, A. Lawrence Lowell, succeeded in bridging the gap by being a member of the M.I.T. Corporation while he was a professor at Harvard. As president of Harvard, he continued earlier efforts to merge the two institutions, despite strong opposition from alumni and undergraduates. Although for a short time a very small number of doctoral candidates, Vannevar Bush, '16, among them, received their degrees from both institutions, the plan was abandoned in favor of the present status of friendly, but independent, neighbors sharing common interests.

The tenure of the present Trustee, Ralph Lowell, has been marked by important changes in direction. After 112 years, the Lowell Institute offered the first public lecture by a woman; Cecilia Payne-Gaposchkin spoke on stellar evolution. Of greater significance was the launching of educational radio and television through WGBH.

Although Mr. Weeks does not draw the conclusion explicitly, it is clear from his book that a major reason for the decline of the public lecture is surely the abundance of other opportunities for education, for intellectual and cultural stimulation, that have been made available by the Lowells and their Institute.

Descendants of Adam(s)

John begat John Quincy; and he begat Charles Francis; and he begat John Quincy and Charles Francis and Henry and Brooks; and John Quincy begat Abigail. And Abigail Adams Homans has written *Education by Uncles* (Houghton Mifflin, Boston, 1966, 149 pp., \$4.00), mainly about Henry and Brooks, the best known of her uncles, with a brief, affectionate appreciation of her father. Not unexpectedly, the book reveals more about young Abigail growing up in the shadow of several illustrious generations than about her ostensible subjects. Girlhood recollections edited with the perspective of age emerge with soft edges. Still, they provide familiar views of men better known through their formal appearances. For example, at the family summer place in Scituate, Uncle Charles liked to swim "in a state of nature." Uncle Brooks's wife used to say, "I call him Brook because Brooks is plural and he is singular." As for Uncle Henry, "he was considered by his adoring nieces as the source of all wisdom." It always astonished Abigail that his "critics should make such a circumstance of his amiable little foibles, and pretenses." This entertaining little book may serve to illustrate why historians, like physicians, should not treat their own families.



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Review on Education

Evolution and Revolution

By Corbin Gwaltney

Virtually every part of U.S. higher education is changing so rapidly these days that no portrait painted today can be guaranteed to resemble its subject tomorrow.

This is true even of those parts of American higher education which for generations have shown the fewest changes.

Consider, for example, the nation's Catholic colleges and universities. It has long been fashionable among educators to class the Catholic institutions among the most conservative of American centers of higher learning, and the classification undoubtedly had much basis in fact.

Traditionally the governing board of the typical Catholic college or university has been composed entirely of persons of the cloth—members, most often, of the religious order with which the college is affiliated. "Outside" influences were thus almost nonexistent, except as they reached, and filtered through, the priests and nuns.

With seeming suddenness, however, all this is in the process of change. For example:

- St. Louis University, a leading Jesuit institution, announced recently that on June 1 its ownership will be transferred from the Society of Jesus—13 of whose members now compose the entire membership of the university's governing board—to a new board, the majority of whose members (18 of 28) will be laymen.
- The University of Notre Dame plans to reorganize its board of trustees to include laymen as well as the traditional members of the congregation of the Holy Cross.
- Webster College, an institution for girls in a suburb of St. Louis, underwent the most drastic metamorphosis of all. Its president announced that the college was severing its ties with its founding religious order (the Sisters of Loretto), that she herself was leaving the sisterhood, and that the institution's affairs would be turned over to a board of laymen.

The Webster College case is regarded by many Catholic educators as extreme, and unlikely to be imitated on other campuses. But the movement exemplified by the St. Louis University and University of Notre Dame actions—an unprecedented involvement of laymen in the governing of Catholic colleges and universities—is expected to grow.

The End of General Education?

Another sector of U.S. higher education in which much soul-searching is taking place is that which is conventionally described as the four-year liberal arts colleges.

A good vantage point for viewing the concerns of the liberal arts institutions is the annual meeting of the Association of American Colleges. This year's meeting revealed the nature of the issues before these schools.

"We must . . . put our minds to making the liberal arts a more coherent force in the community," said one speaker, James A. Perkins, President of Cornell University. Mr. Perkins went on:

". . . The new movement among the independent liberal arts colleges must be toward the universities. The price for the colleges, and perhaps for the universities as well, may be some loss of independence, but . . . between sterile independence and meaningful collaboration, there really is no choice."

At a related meeting, Louis T. Benezet, President of the Claremont Graduate School and University Center in California, said:

"It may be time to declare the formal general education movement dead in America, to stop bowing to its corpse, and to pursue the spirit of learning in fresher ways. Mechanical general education requirements have never really worked; why don't we admit it? Requirements to take introductory courses in all three major divisions were first introduced 60 years ago. Students still speak of them as something to get over, like a childhood disease."

Said Mr. Benezet, "It is time to admit that 'Bachelor of Arts' at present means little or nothing as a symbol for a liberal education. . . . We should have a thorough study on the A.B. comparable to the historic Flexner report on medical education in the early twentieth century."

This is candid talk, even for college and university presidents. People have been tinkering with the so-called "liberal arts" curriculums for years—but strong voices now seem to be calling for a major overhaul, a proposal essentially without recent precedent.

Some of the strongest voices, in this regard, belong to students. Mr. Benezet took note:

"Over the past decade, the teachers' war cry has been 'Excellence!' This cowed the students for a while; but in the past two years they have summoned their forces enough to hurl back their own rebel yell, likewise consisting of one word and quite worthy of the colleges' consideration: 'Relevance!'"

Multidirectional Change

The changes are occurring everywhere—in the big state and private universities and in the two-year junior colleges, as well as in the four-year institutions discussed above. Among them, America's colleges and universities are moving in every direction imaginable—including directions that appear to be completely opposite to one another.

What are the destinations? What will U.S. higher education look like, 10 or 15 years from now?

No one could answer these questions with certainty or precision today, given the changeable nature of the higher education system in this country.

Even those who undertake to analyze the future structure of higher education—a necessary if perilous task, in order to enable Americans to form some idea of what lies ahead—no longer dare to make firm projections. Recently the Carnegie Foundation for the Advancement of Teaching established a commission of distinguished educators, businessmen, and a former governor to conduct a study of where higher education is going and of how, when it gets there, we Americans can manage to pay for it. But Alan Pifer, Acting President of the foundation, acknowledged at the outset that the commission "will have to hypothesize not one or two, but a number of different ways in which the nation's incredibly diverse system of higher education might develop over the next decade or so."

The future course is *that* uncharitable.

A fascinating fact about the whole phenomenon of change in U.S. higher education is that it is occurring in just about every phase of college and university life. It pervades the subject matter of scholarship as thoroughly as it pervades the theories of administration and governance. It affects the design of buildings and instruments as profoundly as it affects the design of curriculums. It involves students and professors and administrators and parents and alumni.

Much of it is a reflection of the innumerable changes that are occurring throughout the expanding American society—urbanization, secularization, and scores of nameless forms of restlessness, of striving for improvement and even for perfection, of impatience with things as they are and of conviction that things can and must be better. But much of it is uniquely characteristic of higher education itself and of the colleges' and universities' obsession with and ambition for—if you will pardon the expression—"excellence."

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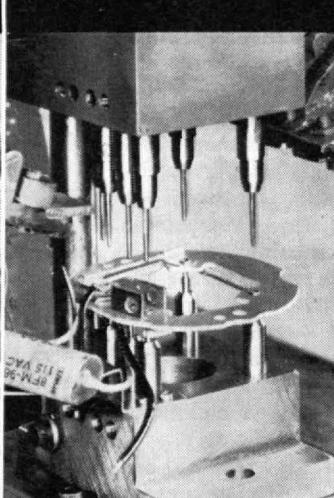
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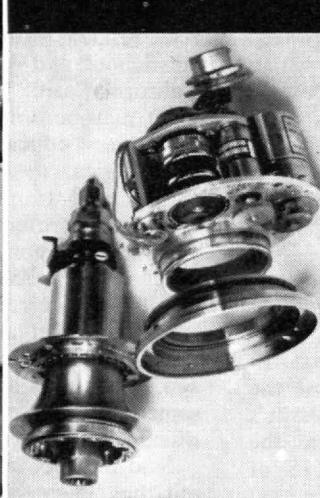
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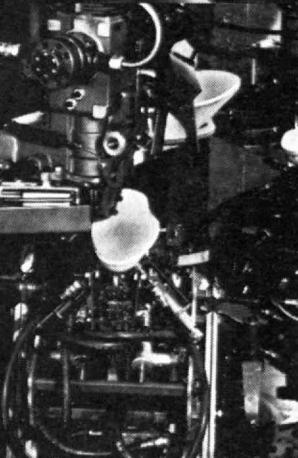
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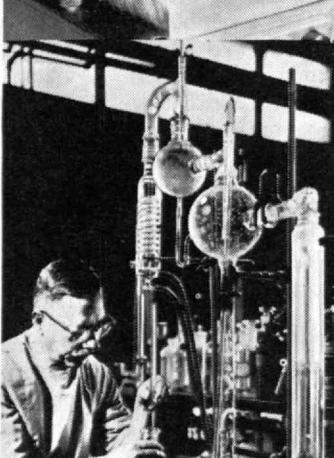
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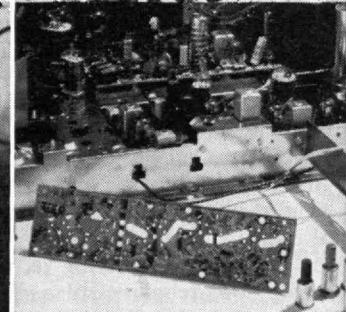
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Puzzle Corner

By Allan J. Gottlieb, '67
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Once again I should like to extend my thanks to the many readers who have submitted problems and solutions. My friends are forever envious of my full mailbox. Several of my neighbors—in particular John Ross, '67, and Joel Shwimer, '67—have requested, "Would all those girls who send you solutions please enclose a recent photograph." John is particularly interested in Anne Cohn from Michigan.

Keep sending your problems and solutions to me. Address them to Baker 4380, 362 Memorial Drive, Cambridge, Massachusetts 02139.

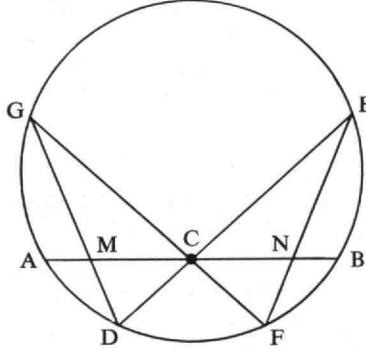
Problems

28♦—Mike Shupp, a former general manager of *TEN*, has posed the following problem:

1 is the smallest integer that is a perfect cube, a perfect 4th power, and a perfect 5th power. What is the next smallest integer with this property? Any number raised to the 60th power has the property, but surely there is some number smaller than 2^{60} . But I haven't found it yet.

29♦—Milton E. MacGregor, '67, submitted the following geometrical puzzle:

Given a circle, Q, with chord AB and C its midpoint. Through C draw any two chords DE and FG. Form DG and FE intersecting AB at M and N respectively.



Prove $MC = NC$.

30—Here's one from Paul W. Abrahams, '56:

Arrange 10 dots on a piece of paper ("10 points in $[0,1] \times [0,1]$ " for you math types—ed.) in such a way that five line segments can be drawn through the dots, and each line segment contains exactly four dots. No two line segments can be colinear.

Let's see some cool shapes.

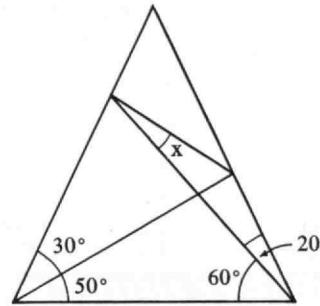
31♦—I have been told by several freshmen that my problems are too easy. Doesn't that fit the "M.I.T. Freshman" image perfectly? For their benefit (and for any new industrious readers), I shall reprint a problem which

no one solved when it appeared last year in *TEN*. As an added inducement, the first person to submit a correct answer will receive a year's subscription to *TEN* or *Technology Review*. This problem was submitted by "the little guy," Harvey Friedman (his class varies as the 4th power of the current humidity).

Let C be the set of those reals whose base 3 expansions have no 1's. Can every real be expressed as a finite sum of elements of C?

OK, frosh, consider yourselves challenged.

32—Roger W. O'Dell, '68, wants you to find x:



33—Since I have such a lovely backlog of problems (keep 'em coming) I will dispense with the *Speed Department* and print two more regular problems. The first is from David W. Drumm:

What is the least number of queens that can be placed on a chessboard in a manner such that any additional queen would result in three being lined up?

Dave advises me to print any solution with fewer than 14 queens. So be it.

34—The final problem is from Richard Bator, '65:

You sit south and must make 7 spades. West's opening lead is the king of clubs. How do you play the hand given the following distribution?

North (dummy)

♠ A K Q J
 ♥ A Q 8
 ♦ Q J 10 9 8 7
 ♣ —

West

♠ 5 4 3 2
 ♥ K J 10 9 7 6
 ♦ —
 ♣ K Q J

East

Immaterial

South (declarer)

♠ 10 9 8 7 6
 ♥ —
 ♦ A K
 ♣ A 10 9 8 7 6

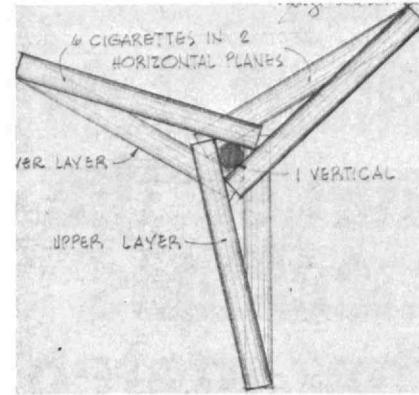
At first it looks like you have it off the top. But when you start playing you realize that all vital transportation is missing. Then you think there is no solution. But there is!

Solutions

15—Place 7 unbent cigarettes such that each one is touching the other 6.

The Green Phantom sent in a beautiful

full-scale model. Thanks, G.F., your Gauloises masterpiece is now one of my prized possessions. A drawing came from Eric Rosenthal, and George L. Downie, '51, sent the drawing reproduced here:

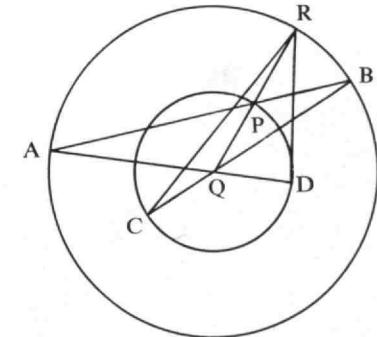


This problem was also solved by Murray E. Denofsky of Project MAC.

16♦—Prove that none of the Platonic solids may be dissected into another (two-page proof).

Mark H. Yu, '70, sent in a published solution.

17♦—Prove that $\overline{RD}^2 - \overline{RC}^2 = \overline{PB}^2 - \overline{PA}^2$.



The circles have center Q, and CB and AD intersect at Q.

Douglas Hoyleman, '64, sent in the following solution.

Let r = small radius = $CQ = PQ = DQ$

Let s = large radius = $AQ = RQ = BQ$

Let w = angle RQD

Let x = angle RQC

Let y = angle PQB

Let z = angle PQA

Applying the law of cosines:

to triangle RQD : $\overline{RD}^2 = r^2 + s^2 - 2rs \cos w$

to triangle RQC : $\overline{RC}^2 = r^2 + s^2 - 2rs \cos x$

to triangle PQB : $\overline{PB}^2 = r^2 + s^2 - 2rs \cos y$

to triangle PQA : $\overline{PA}^2 = r^2 + s^2 - 2rs \cos z$

Hence $\overline{RD}^2 - \overline{RC}^2 = 2rs(\cos x - \cos w)$

and $\overline{PB}^2 - \overline{PA}^2 = 2rs(\cos z - \cos y)$

But $w + z = x + y = \pi$;

hence $\cos w = -\cos z$ and $\cos x = -\cos y$,

so $\cos x - \cos w = \cos z - \cos y$;

therefore $\overline{RD}^2 - \overline{RC}^2 = \overline{PB}^2 - \overline{PA}^2$.

Mark Yu and Claire Parkinson (Wellesley '70) also sent in solutions, and I have a beautiful and comprehensive proof from Helen Means.

18♦—Evaluate in five seconds or less:

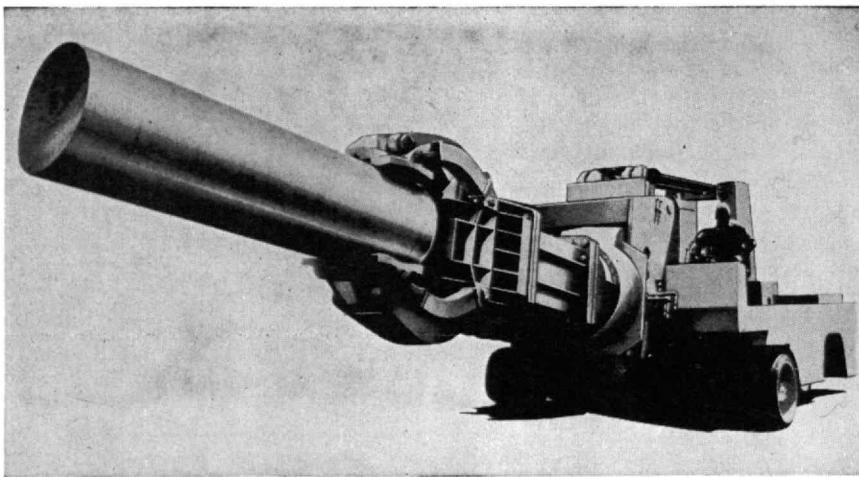
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Puzzle Corner

$$\int_{-e^{2x}}^{e^{3x}} \int_{-2}^2 \int_{-e}^{2\pi} \frac{25 \cosh(\ln 3)}{\ln(e^{2x} + \ln 2x e^x - 1)^x + 2 \sin x} \sin x \, dx \, dy \, dx$$

Alas, this one slipped by the "old pro" himself. Yes, Virginia, problem 18 was trivial with 0 the obvious answer. As expected, the insults poured in. Here are a few:

Dear Mr. Gottlieb:

Did you really take my problem seriously? How many readers noticed that even though I wrote a triple integral, I only wrote one differential to integrate over? That was my mistake.

Once that is corrected, there are two solutions to the problem. The classic solution that any 18.01 dropout can see is that

$$\int_{-\pi}^{2\pi} \sin x \, dx = -e^{-1n\frac{1}{2}} = -2,$$

from which it can be seen that the integral must be 0. A new solution has just been brought to my attention: Any integral of that complexity must equal 0, because no one would have the patience to actually work something like that.

Mark B. Pelcovits, '70
East Campus

Dear Mr. Gottlieb:

I suggest that the problem was submitted as a test more of *your* intelligence than the reader's. Since one quickly notices:

$$-e^{-1n\frac{1}{2}} = \int_{-\pi}^{2\pi} \sin x \, dx = 2$$

everything disappears and = 0 is answer. Hereafter publish only useful problems, please.

Charles Dorian, '68
Student House

First of all the limits are *not* equal to 2, as Mr. Pelcovits has pointed out. Second, why don't you *answer* only useful problems.

Also solved by Leo G. Chouinard, '70, David W. Thiel, '70, Robert A. Parker, '70, Kyoichi Haruta, '63, Mark H. Yu, '70, Paul Schweitzer, '61, and Miss Parkinson.

22—Let (a_α) be a non-empty set of reals. Define the distance set of (a_α) to be $(b \text{ such that } b = a_\beta - a_\gamma)$. What can be said about distance sets (measure, open, closed, connected, etc.)? In particular, what are some necessary and/or sufficient conditions for a set A to be the distance set of any set. For example, A must contain 0 and A cannot be $(0, 1, 3)$.

Despite the fact that I offered a free subscription to *Tech Engineering News* for the best solution to this problem, I did not receive any solutions. Now the offer is extended, and the prize becomes the reader's choice of free subscriptions to *TEN* or *Technology Review*.

Mr. Hoyleman, who is now going for a Ph.D. in mathematics at the University of Arizona, writes:

Dear Mr. Gottlieb:

The distance set puzzle as given in the November *Technology Review* is the sort of thing that I can't stop working on once I get started. I was able to prove the following results: (dA is the distance set of A).

If A is open, connected, bounded, or compact, then so is dA , but if A is closed, dA need not be closed.

If A is infinite, the cardinality of dA is equal to that of A .

If A has n elements and dA has m elements, then $2n - 1 \leq m \leq n(n - 1) + 1$, and these are the best possible bounds.

$A = dA$ if A is a subgroup of the additive group of real numbers.

There is a set of Lebesgue measure zero whose distance set is the entire real line.

You probably are already familiar with most of these properties, but if any are new to you let me know and I'll write up a proof. The one thing I did not succeed in doing was to find a necessary and sufficient condition that a set be the distance set of some set (though there is the necessary, but very insufficient, condition that the set contain 0 and be symmetric about it, and the sufficient, but quite unnecessary, condition that the set be a subgroup of the reals). From the above results it doesn't seem possible to characterize it by cardinality, measure, or topological or algebraic properties.

Thank you, Doug, and good luck at Arizona. This problem first appeared in *Tech Engineering News* for April, 1966, and found no solution. We reprinted it again this fall, offering a free subscription to either *Tech Engineering News* or *Technology Review* for a solution. So let me know if you want your free one-year subscription to be for *TEN* or *TR*. I am sorry but I have no similar arrangements with *Playboy*. I would be very happy to receive your proofs, and will print all that space permits.

Due to deadline variations and space limitations over which I have no control, many readers did not receive credit for successful solutions. Although I doubt that anyone really would be heartbroken if his name did not appear, I consider myself morally obliged to give credit where credit is due.

These people sent in solutions to the problems indicated:

1. Douglas K. Severn, '23, Douglas King, and Elizabeth Cox Worden, daughter of Edwin S. Worden, '31.
2. David W. Drumm, '68, Martin Lan-

dau, Frank R. Hanawalt, '54, (Pennsylvania State University), Steven Raneri, Mr. Severn, and Mr. King.

4. Douglas Hoyleman, '64, Mr. Severn, Mr. King, and Mr. Landau.

5. George Schnitzler, '21, Milton E. MacGregor, '07, Mr. King, and Mr. Severn.

6. Mr. King and Mr. Severn.

7. Mr. Landau, Mr. King, and Mr. Severn.

8. Robert G. McKean, '64, and Mr. Hoyleman.

9. Mr. McKean, Mr. Hoyleman, Mr. Landau, and Mr. Severn.

10. John Joseph, David C. Lukens, '57, Mr. McKean, Mr. Landau, and Mr. Severn.

11. Captain John Woolston, '44, Mr. McKean, Mr. Landau, and Mr. Hoyleman.

12. Captain Woolston, Mr. McKean, Mr. Landau, Mr. Hoyleman, Mr. Joseph, Mr. Drumm, Mr. Severn, Hubert duB. Lewis, '37, Gardner Perry 3rd, '61, Mark Pfeil, John Newbegin, '34, Eugene F. Kelly, '54, Joseph N. Feil, '60, Stanley A. Horowitz, '66, Anne Harris Cohn, '67 (University of Michigan), Alexis Ostapenko, Martha C. Morrison (daughter of Samuel G. Morrison, '44), Russell A. Nahigian, '57, Alexander F. Robb, '41, Paul Siegel (son of Professor Abraham J. Siegel), John Fielding, Donald F. deRegnier, '60, Earl J. Rogers, '59, and Richard Bator, '65.

13. Mr. Joseph, Mr. Bator, Mr. McKean, Mr. Hoyleman, and Mr. Severn.

14. Frank G. Smith, '11, Thomas S. Fulmer, '61, Captain Woolston, Mr. Joseph, Mr. McKean, Mr. Hoyleman, Mr. deRegnier, Mr. Feil, and Miss Morrison.

Letters on Review

Prime Mover

To the Editor:

The article on Sensory Aids in the December *Review* is excellent—as history and as a résumé of current work.

I hope you'll pardon a bit of personal pique, if, as the prime mover now six years of the Mechanical Engineering Sensory Aids group, the proposer, first year principal investigator, and currently Steering Committee Chairman of the Center for Sensory Aids Evaluation and Development, and Chairman of the Subcommittee on Sensory Aids of the National Academy of Sciences-National Research Council, I felt somewhat left out.

ROBERT W. MANN, '50
M.I.T., Cambridge, Mass. 02139
The apologies are all due from Technology Review.—Ed.

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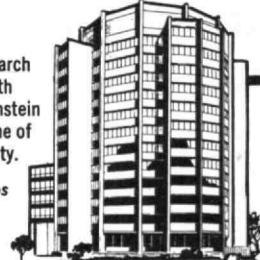
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Molecular Biology and the Future of Man

New understanding of the basis of life is increasing man's well-being, but it confronts him with ethical problems

By Irwin W. Sizer

The molecular biologist tries to explain the properties of living organisms by isolating and determining the structure and function of individual molecules of the cell. The arrangement of certain macromolecules such as polysaccharides, lipids, proteins, and nucleic acids into functional structures, known as micro-organelles, which are visible under the electron microscope, is of special interest, since this provides vital information concerning the way in which these molecules can co-operate to bring about the biochemical reactions peculiar to life itself. The figure on page 17, which shows a typical cell as visualized with the electron microscope, indicates these organelles.

In this article I shall pay special attention to the mitochondrion, the energy source of the cell, the chromosomes, where nucleic acids (DNA and RNA) are manufactured, and the ribosomes, the sites where proteins and enzymes are produced. The enzymes in turn are responsible for the metabolism of carbohydrates, fats, proteins, etc., which characterizes living organisms.

Of paramount importance in the living organism are the giant molecules of protein and nucleic acid which constitute the cellular machinery. Most of the proteins have molecular weights of 10,000 to 200,000 and are in fact biocatalysts, or enzymes, which bring about all the chemical reactions characteristic of living organisms.

The fuels which operate the cell machine are molecules of sugar, fat, and amino acid which burn with oxygen in the enzymatic cell furnace, the mitochondrion, to yield energy and waste products. The energy derived when food burns in this way is stored in a chemical bank whose coinage is called ATP (adenosine triphosphate). Whenever energy is needed for synthesis, muscle contraction, cell division, etc., it is paid for with ATP currency.

Enzyme proteins are obviously key molecular catalysts concerned with cell metabolism and participate in all the attributes which distinguish the quick from the dead and inanimate world. It is therefore crucial that we understand how 20 different amino acids are linked together into long polypeptide chains which are wrapped up into a ball to form a large protein molecule, or enzyme (see figure on page 18). When the ball is unwound (denatured) the biological activity of the molecule is destroyed. A special part of the protein surface made up of only a few very special amino acids is the active site (shown as the area within the circle in the figure), the business end of the molecule responsible for catalysis. Often attached to this active center of the enzyme is a metal atom or a co-enzyme containing a vitamin. Clearly the metal or the vitamin on the active site plays a vital role in the enzyme-catalyzed reaction and hence the active site could be the Achilles' heel whereby the scientist might control enzyme action within the living organism. Chemicals, hormones, poisons, and drugs which combine with the enzyme can drastically influence its activity and hence change its role in cell metabolism; using the appropriate agent, the scientist might produce a specific influence on the cell.

The Code of Life

Another mechanism for regulating the chemistry of the cell makes use of the system which controls the amount of an enzyme manufactured to catalyze a given chemical reaction. The engineer who put together the first living cell had this in mind when he placed nucleic acids (DNA and RNA) in the genes of the nucleus and in the ribosomes of the cytoplasm to determine which protein or enzyme would be synthesized in what amount at any given moment in the life history of the cell.

DNA constitutes the hereditary material located in the genes of the chromosomes in the nucleus of the cell. By duplicating itself when the cell divides, DNA makes available the store of genetic information for the next generation. This information is coded in the special arrangement of the four basic building blocks known as nucleotides, arranged in a unique sequence along the DNA polymer which has a molecular weight of a million or more. Each nucleotide is made up of a base—adenine, guanine, cytosine, or thymine—attached to a sugar (deoxyribose) and phosphate; the phosphate group links one nucleotide to the next.

DNA molecules are arranged in pairs twisted around each other to form a double helix. During cell division the partners of the pair separate and each reproduces an exact duplicate of itself. Each DNA molecule or gene contains a blueprint (determined by the linear order of the four bases) for constructing a specific protein out of some 2,000 which occur in a bacterium or a man. The message of the DNA is 'read' and transcribed with the co-operation of specific enzymes to form a very similar molecule of messenger RNA. This messenger proceeds from the cell's nucleus to the cytoplasm where it becomes attached to the ribosome, the protein manufacturing plant of the cell.

Another type of nucleic acid, called transfer RNA, picks up amino acids from the cytoplasm and carries them to the ribosome; there they are assembled into polypeptide chains which are then rolled up into globular proteins. The precise ordering of the 20 different amino acids along the chain results from the translation of the blueprint (coded by the proper sequence of three of the four nucleotides) represented by the specific messenger RNA. The ribosome is so versatile that it can synthesize any one of hundreds of different proteins given a proper supply of amino acids and the correct RNA blueprint to transcribe.

With this picture of protein biosynthesis before us, it immediately becomes apparent that the control of protein synthesis must be critically important to the cell. Regulation or interference is possible at every step, from the DNA in the chromosome to the release of new protein molecules from the ribosome. These protein molecules, functioning as enzyme catalysts for all reactions of life, are in turn subject to activation and inhibition. Hence we see that at the heart of the living cell is an elaborate ultrastructure which provides for the formation and function of enzymes and nucleic acids. Now that a major breakthrough has been made in our knowledge of how these macromolecules operate in the living

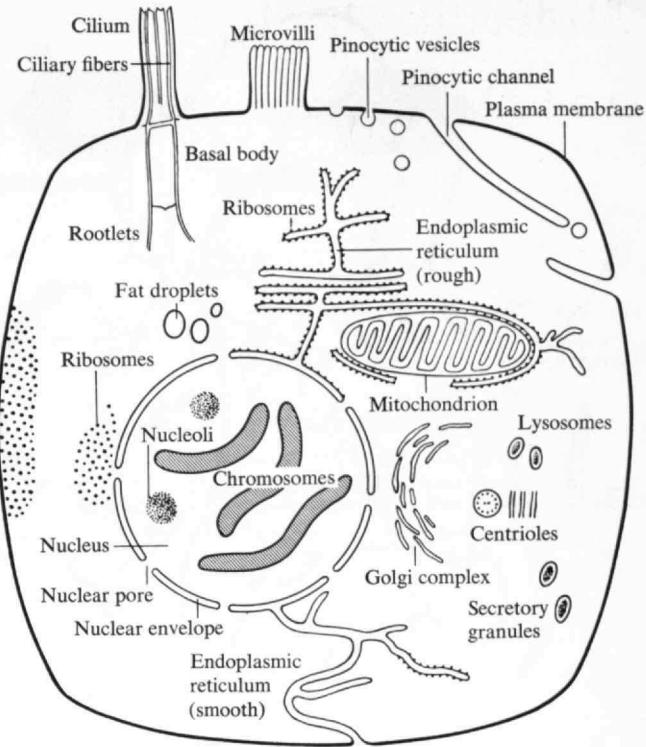
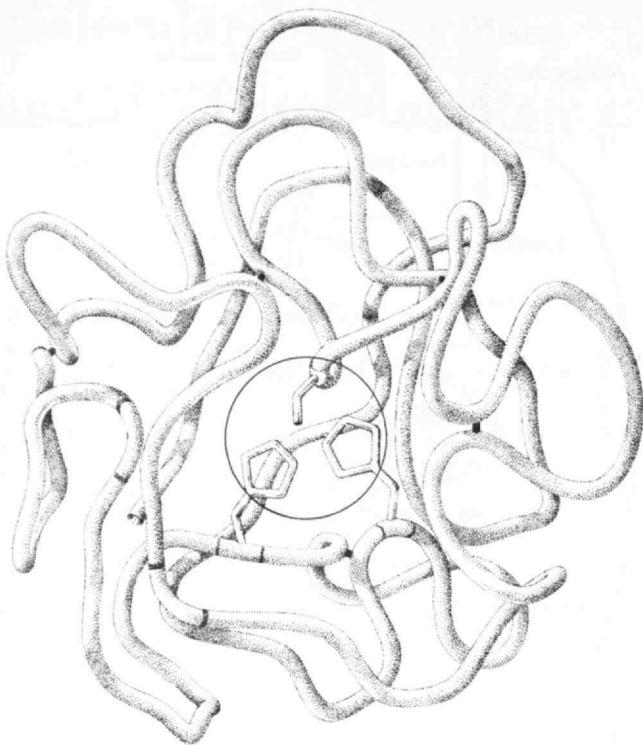


FIGURE: HOLT, RINEHART AND WINSTON INC.

Stylized diagram of a typical cell, as seen under the electron microscope. To the molecular biologist, three of the most important constituents of the cell are the mitochondria, which produce the cell's energy, the chromosomes, in which the nucleic acids DNA and RNA are produced, and the ribosomes, where proteins and enzymes are synthesized.



Protein molecule consists of long chains of assorted amino acids wrapped up into a ball. The part of the molecule responsible for catalyzing reactions inside the cell is known as the active site (indicated by the area inside the circle). By attaching chemicals, hormones, poisons or drugs to this site, the molecular biologist can drastically influence reactions in the cell.

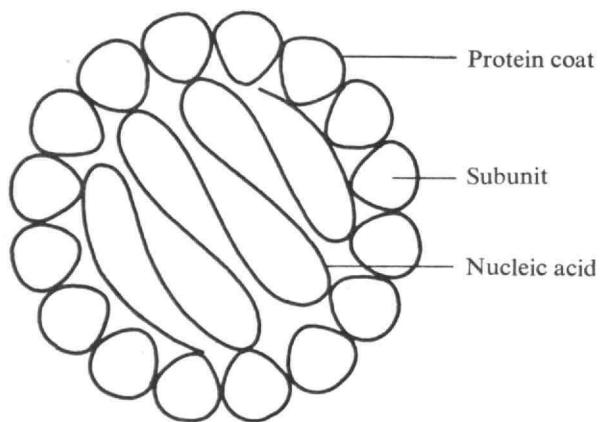


FIGURE: M.I.T. PRESS

Typical virus particle, such as the polio virus, consists of nucleic acid inside a shell of protein. Research into polio at the molecular level has so far failed to produce a cure for the disease; however, the work of unraveling the structure has given rise to forms of the virus which produce immunity to the disease.

cell, it is possible to influence this delicately balanced machine for our own purposes, whether it be preventing and curing disease, destroying crops, polluting the environment, or slaughtering our fellow man.

Genetic Defects at the Molecular Level

What a few macromolecules might be doing in a particular type of cell in the body would seem to have little, if any, relevance to the well-being of man. But on the contrary, evidence has accumulated that it is of critical importance. For example, hemoglobin, which transports oxygen in the blood stream, is assembled from amino acids by cells in the bone marrow into a large protein of molecular weight 68,000. This protein contains four iron heme groups to which the oxygen is attached. The 20 different amino acids of hemoglobin are arranged very precisely into four polypeptide chains, each of which contains some 130 or more amino acids. A special DNA molecule in the chromosome which contains the proper blueprint for hemoglobin insures their correct sequence.

In the hereditary disease, sickle-cell anemia, a mutated DNA causes the production of an abnormal hemoglobin molecule which cannot function properly. Hence an individual who inherits two traits—one from each parent—for this anemia is unable to transport oxygen and dies of the disease. Professor Vernon Ingram has spent years analyzing normal and sickle-cell anemia hemoglobin and has concluded that the molecules differ only by the substitution of the single amino acid, valine, for glutamic acid in the peptide chain! The substitution of Val for Glu was, in turn, caused by a change in the chromosome of one codon (a set of three nucleotides which codes for a particular amino acid) in the DNA for hemoglobin. Since such a minuscule change in a huge molecule can be lethal to man, it is clear that the structure and function of a single macromolecule can be crucially significant in the physiology of the body.

Examples of genetic disease at the molecular level are becoming more numerous as molecular biologists and medical researchers combine forces. Although such genetic defects are incurable, we are not always powerless to relieve the symptoms. The hereditary disease phenylketonuria (PKU) provides one example of this. In this disease, particular ketone molecules, often colored, appear in the urine. The defect is accompanied by severe mental retardation and the sufferer is usually an idiot.

Biochemists have shown that in this disease the amino acid, phenylalanine, is not properly metabolized because one oxidizing enzyme, called a hydroxylase, is lacking; this, in turn stems from the presence of a defective DNA for its synthesis. Hence toxic waste products (phenylketone bodies) are produced from phenylalanine, which cause irreversible damage to the brain. It has been found that if phenylalanine is drastically reduced in the diet of the newborn these abnormal products are not produced and the developing child has an I.Q. in the normal range. However, this defect must be dis-

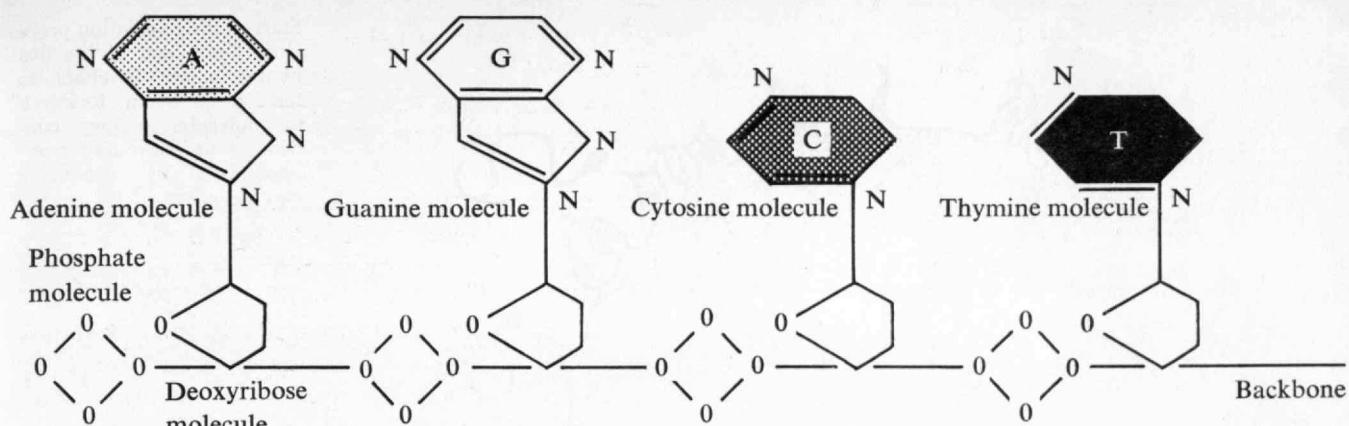


FIGURE: CHARLES E. MERRILL BOOKS INC.

covered at birth, since phenylalanine toxic products permanently affect the nervous system. So rapid are the applications of research to the needs of mankind that now, a few years after the discovery of these facts, every progressive hospital in the country tests newborn infants for this genetic disease, and modifies the diet at once if phenylketonuria is discovered. The DNA defect remains unaltered, however, to reappear in the next generation.

As a result of this medical progress, society is faced with the agonizing decision as to whether or not individuals with serious genetic defects should be permitted to have children. Obviously the approach should be through education, which would discourage responsible people from having children when the odds strongly favor the prospect of seriously abnormal offspring.

Prevention and Cure of Disease

I shall cite only a few examples of the prevention and cure of disease to illustrate the power of molecular biology. Often the initial basic work involves an attempt to understand the mechanism whereby molecules play a role in the living cell and bears no relation whatever to possible medical applications. Such was the case with transaminase (glutamic-aspartic), an enzyme isolated from the heart and found to be concerned with the metabolism of amino acids. Our group at M.I.T., after several years of work extracting many hundreds of pig hearts, was successful in obtaining this enzyme in a very pure form. We found that each transaminase molecule, of molecular weight 110,000, contained two molecules of vitamin B₆, in the form of pyridoxal phosphate, attached to the protein part of the enzyme. Owing to the presence of the vitamin this enzyme is pale yellow and a change in color can be used as an index of the effect of various chemicals upon its catalytic activity. Among many inhibitors we investigated using this color change was the drug isoniazid. This combines with the vitamin B₆ and thereby destroys the enzyme.

Other laboratories then proceeded to see whether or not this drug could inhibit transaminase (or other B₆ enzymes) in bacteria. *Tuberculosis bacillus* was found to be especially sensitive and in tests on animals isoniazid was found to have a fairly low toxicity. When tried out on tuberculosis patients it turned out that isoniazid produced almost miraculous cures. Isoniazid (along

Four basic building blocks of DNA, the hereditary material of the cell. The special sequence of the four bases adenine, guanine, cytosine and thymine along the DNA chain is the blueprint for a specific protein, and so determines the nature of the cell.

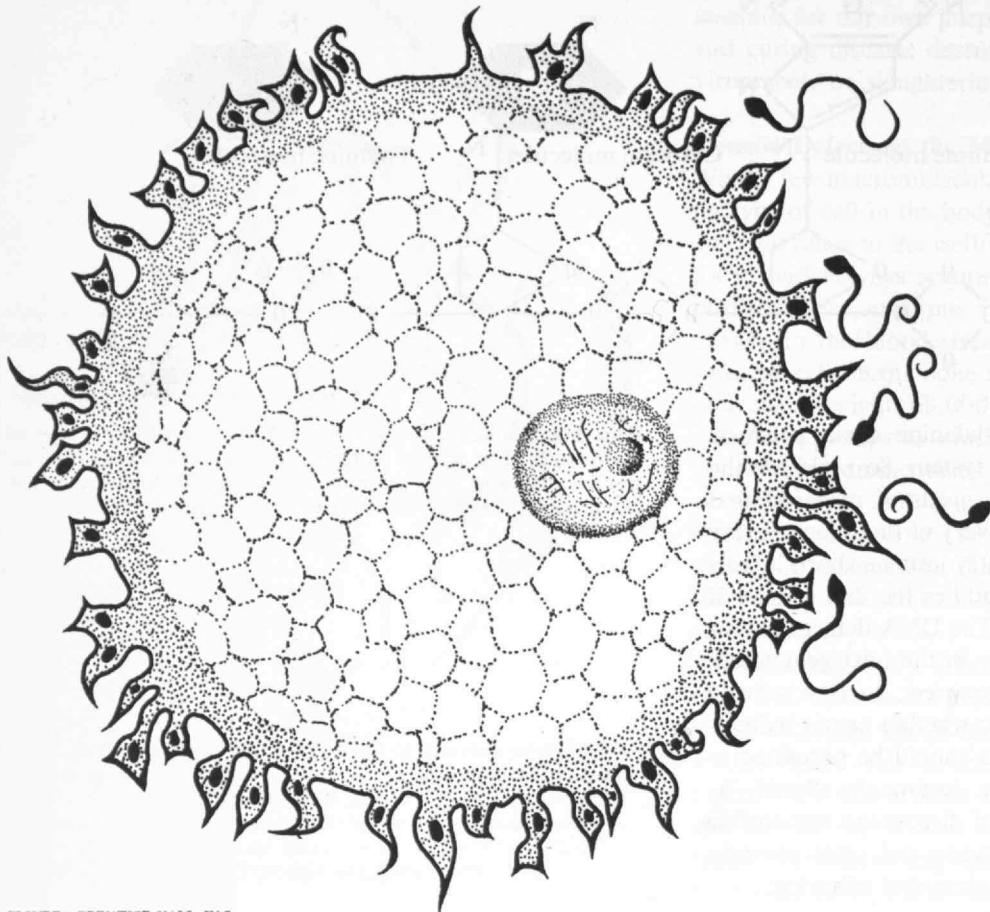


FIGURE: PRENTICE-HALL INC.

with related drugs) is so successful in fact that many tuberculosis sanatoria in business for decades have had to close their doors for lack of patients.

The solution to the problem of disease can come from prevention as well as cure, as in the case of poliomyelitis. The long and arduous research on polio is negative so far as finding a cure for the disease is concerned. However, isolation of the polio virus from the brain of infected monkeys, followed by growth of the virus on a tissue culture of monkey kidney cells led to the final preparation of the virus in pure form in large amounts, and the determination of its protein and nucleic acid structure. Dr. J. Salk then embalmed the virus with formaldehyde to form a dead virus which was still able to produce immunity. A little later, Dr. A. Sabin discovered a weak strain of live virus which could immunize against polio without causing the disease.

Chemotherapeutic agents such as sulfa drugs and antibiotics have been found to be effective against bacterial disease because of their ability to block essential enzymes or to inhibit the DNA-RNA machine required for synthesizing such enzymes. Some drugs which interfere with the biosynthesis and metabolism of DNA and RNA have proven invaluable in the treatment of certain types of cancer. The original breakthrough came when Dr. Sidney Farber used the anti-folic acid drugs, aminopterin and amethopterin (methotrexate), to treat childhood leukemia, at the Children's Hospital in Boston. Although these drugs did not cure the cancer, they held it

Start of the population problem (left): one of the five human sperm is about to fertilize an ovum. Research in molecular biology contributes to alleviating overpopulation by producing contraceptives.

Pollution of the air, the land, and waters increasingly threatens the quality of our environment (right). Many pollutants produce their toxic effects by interfering with the cellular machinery at a molecular level.

in check and opened the way for tests of chemicals designed as antivitamins and antimetabolites to be used to "throw a monkey wrench" into the vital machinery of the cancer cell.

Each year thousands of such chemicals are synthesized by industry and universities, tested on enzyme systems, then on bacteria, tissue culture of cancer cells, animals, and finally on human patients dying of cancer. From this search, costing over 100 million dollars each year, may come one or two drugs to be added to the armory against cancer and many other diseases.

Unfortunately none of these chemotherapeutic agents has been effective in the cure of virus disease, including the common cold and influenza. Just available to physicians, however, is the first anti-viral agent, amantadine hydrochloride (Symmetrel) developed by the du Pont company, after many tests on virus-infected tissue cultures. This amazing drug is effective against Asian flu (influenza A), and perhaps certain other viruses. It appears to owe its effectiveness to its ability to interfere with the penetration of the virus through the plasma membrane into living cells. In view of this general mechanism for closing the door of the cell to viruses, Symmetrel and related drugs may find use in the treatment of other virus diseases, such as German measles, etc.

I could describe many more equally remarkable examples of current advances in the prevention and cure of diseases of the heart, blood vessels, kidney, brain, liver, etc. It is already clear, however, that progress



PHOTO: FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

in solving the "sweet mystery of life" at the molecular level is rapidly resulting in applications to the prevention and cure of disease not only of man but of animals and plants as well. In no small measure, advances in agriculture, food, and nutrition have stemmed from our knowledge of the innermost workings of the living cell as determined by molecular activity. It is equally certain that molecular biology has contributed to the production of a healthier, more long-lived man who, in theory at least, might become a more productive and happier individual than his ancestors.

New Problems for Mankind

In some ways applications of molecular biology to medical advances have succeeded almost too well and have created new problems for society to solve. The major increase in longevity is not always a blessing, especially if one's last years on earth are accompanied by infirmity, mental retardation, and suffering. With the medical tools now available we could often prolong life beyond any capacity to enjoy it and rob the aged of the "dignity of death" when they are prepared to face it with equanimity. As a consequence of medical progress, society is assuming an ever-increasing economic and social burden related to the support and care of the elderly.

An even more alarming consequence of our success in the prevention and cure of disease is the resulting decrease in mortality and the astounding multiplication of the population in many parts of the world today. For

example, in parts of Latin America the population is doubling every 15 years. If the rate of growth of the world population continues unchanged, the population will double by the year 2000; by 2600 one person will occupy every square yard of space. By 3600 the weight of people on the earth could equal that of the earth itself! On the one hand, civilization could be wiped out by an explosion of the hydrogen bomb, but on the other it could destroy itself by the population explosion. It is already clear that the population of certain countries is above an optimum size, resulting in pestilence and starvation and leading to an unstable economy and government, and misery for millions of people.

The remarkable progress in our understanding of human reproduction and the hormonal control of ovulation has led to the development, through molecular biological research, of steroid hormone drugs (the pill) which prevent ovulation, or of plastic coils and rings (IUD's) which prevent pregnancy. Still other approaches to the control of fertility are being developed which offer great promise for the future. It remains to be seen, however, whether man is intelligent enough to make use of this knowledge before it is too late. The problem in this field is as much one of educating the general public as it is research leading to basic knowledge and its application.

Man is already contaminating his environment to the extent that it outrages his aesthetic sense; his other senses are becoming equally compromised by irritants

and poisons to the limit where pollution has become a major hazard to man himself. Our crystal-clear streams and lakes have become open sewers, and our fresh, clean air stings our eyes and bites our noses with foul and poisonous chemical wastes. Synthetic detergents can contaminate our tap water to make it froth and foam, and carelessly used insecticides can kill fish and birds, as well as inhibit and destroy enzyme systems of insect pests. Our coastal waters have become so contaminated with human and industrial wastes that recreational use is impaired and shellfish are destroyed or have become too contaminated for human consumption. The various agents involved in pollution share in common the ability to destroy or injure living creatures. What is not generally realized is that many chemicals involved in pollution produce their toxic effects by interfering at the molecular level with the cellular machinery. Here, then, is another region to which the molecular biologist can contribute.

Despite this unhappy situation involving the contamination of our environment, it appears that knowledge is already available or likely to be produced from research in molecular biology in the near future which will make it possible to combat this pollution of land, sea, and sky. The use of such information will require large sums of money, and it is necessary to educate the public to understand that such steps are essential to eliminate pollution, stagnation, and auto intoxication, and to regain an 'America the Beautiful.'

Discoveries arising from molecular biology are neither good nor evil; whether they become a blessing or a curse is determined by the use that man makes of them. An example of this dual nature occurs in the nerve gas, diisopropylfluorophosphate (DFP), which can inhibit the enzyme acetylcholine esterase and hence interfere with nervous function. During wartime it can be used to eliminate enemy troops, but during peacetime it serves as an effective insecticide.

Although there is no research on biological and chemical warfare at M.I.T., an interesting case is supplied by scientists who have recently isolated and identified from moldy peanuts a chemical, aflatoxin, so deadly that one part per million in the diet of a rat can produce cancer of the liver; one can imagine the possible effects on people. On the one hand knowledge of this compound may lead to the prevention of death from the consumption of moldy peanuts, but on the other, an enemy might use such an aflatoxin in biological warfare. Weapons for biological and chemical warfare have received relatively little publicity, but those who are knowledgeable in this field are deeply concerned that such agents might be used without careful consideration of the dire consequences.

The Outlook for the Future of Man

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With these stunning vistas ahead for mankind we must not lose sight of the possibility that the world could easily deteriorate and man could become a less healthy and happy creature than he is today. Unless we find some way to control the population explosion (other than by starvation, disease, the hydrogen bomb, or chemical and biological warfare) as well as environmental pollution, we can anticipate serious trouble. Similarly, misuse of our deepening understanding of human heredity can have disastrous effects on future generations.

Although the pendulum could swing either way, the outlook for the future is not a discouraging one on the whole. As long as the general public is willing to spend 1.5 billion dollars or more a year for biomedical research, we can expect advances in our knowledge of man in sickness and in health and should succeed as well in "cracking the code" of life at the molecular level. From such basic investigations will continue to stream applications to medicine and human welfare.

Perhaps the most encouraging aspect of the outlook for the future is the advances which are being made in education at all levels. For example, it is not unusual for students in many secondary schools to have the equivalent of an introductory college course in biology. More and more adults are keeping abreast of recent progress in biology and medicine from reading newspapers, magazines, and paperbacks. The need for lifetime learning is resulting in programs of continuing education in many of our colleges and universities. As a result, an enlightened population is being developed which can cope with the serious ethical, moral, and social issues faced by society as a result of advances in biomedical research. Hence, what "Man may be" is determined not only by science, medicine, and engineering, but by man himself and his ability to control his own destiny.



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Precision Ball Bearings: 10^5 Hours at 20^4 r.p.m.

A brief history of technology's quest for ultimate accuracy features seat-of-the-pants engineering and scientific research

By William G. Denhard, '42

$$(2 \times 10)^2 = 20^2 = 400$$
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The ball bearing seems a relatively simple device: two steel rings; some steel balls; and, if necessary, a cage or separator to prevent ball-to-ball contact as the bearing rotates. Normally, two bearings are required to support a rotating element like a wheel or shaft. If free play is to be eliminated from the rotating element, the two bearings are preloaded against each other and mounted with an interference fit.

The concepts of the ball bearing are not new. The Egyptians used a single crude ball under the masts of their ships, and the Romans developed this primitive bearing into a circular arrangement of round, polished stones. Today, chiefly because of new requirements for high-speed precision gyroscopes for navigation, ball bearings have been redefined as precision positioning devices, and they may be engineered so that they show literally no wear during their useful life of up to several years of rotation at 24,000 r.p.m. and higher.

Some of the problems inherent in the ball bearing lie in the physical shape of its components. A ball is a naturally generated shape which can be fabricated by processes that produce hundreds or thousands of identical-size balls that are genuinely round. On the other hand, the rings or ball races are not naturally generated shapes. The race grooves must be formed with a shaped tool or by race rotation about an offset center.

Ball bearings are at last being studied by scientists engaged in developing the theory of elastohydrodynamic lubrication. In the elastohydrodynamic theory, the lubricant's role is not merely to reduce friction or cool the rubbing parts of the bearing, but to establish a fluid film that physically prevents ball/race contact and thus eliminates wear. The thickness of this elastohydrodynamic film in the bearing load area is on the order of a few microinches.

An automobile front wheel bearing wholesales for about \$5. A semi-mass-produced gyro-spin-axis bearing costs 30 or more times this figure for the most accurate applications and the long life indicated. The bearing industry took 25 years to overcome the twin problems of achieving today's accurate race geometry and the development of what are still limited markets for truly accurate and expensive bearings. Without the impetus provided by U.S. Air Force support of M.I.T. efforts in bearing research and M.I.T. subcontracts to bearing manufacturers, these problems would still characterize the bearing industry today.

The evolution of precision gyroscope ball bearings really began in 1947-1948, when M.I.T. subcontracted with a bearing manufacturer to study bearing preloading and make accurate measurements of the bearing dimensions required for accurate preloading. As a result, accurate measuring and cataloguing of components brought variations in bearing bore and dimensions under control so that two bearings with like bores and diameters could be selected for coupling as a matched pair. Shafts and wheels were then machined to match the bearings. Gyroscope designs were simplified to allow for easier machining and assembly of components.

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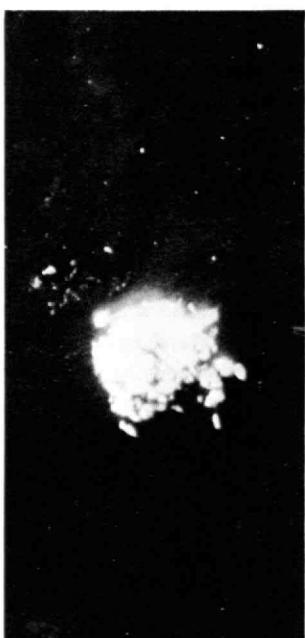
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Degraded oil and other contaminants are a principal cause of precision bearing failure. Abrasive aluminum oxide particles, almost invisible under white light (left), show clearly under polarized light because of their double-refracting properties.



Cleanliness during assembly was constantly improved until bearing work was eventually done in a room isolated from machine shop dirt and chips. After a time, even smoking was banned in the bearing assembly room, and special kinds of procedures such as these remain the rule today. The knowledge gained from this study temporarily brought the measurement of bearing geometry to an accuracy level higher than the other parts of the gyroscopes in which they were to serve.

Lubrication: Too Much and Too Little

About 1952, instrument specifications were again tightened. It was then discovered that the oil in the bearings was moving about so freely that it degraded instrument performance at this new and higher level. Centrifuging of bearings came into vogue as a means of eliminating this severe oil migration. Naturally, very little oil was left on the metal parts and the bearing was then very dependent on a reservoir of oil held in or on the body of the ball cage.

With tightened performance specifications and longer life requirements, bearing failures in complete gyros became more costly, and so bearings were run for several hundred hours before being assembled into instruments to better predetermine life and performance. These prerunning, centrifuging, and screening techniques gave improved instrument performance and life, but bearing yield decreased. The yield even varied in cycles from shipment to shipment; some shipments had very low yield while others had 80 to 90 per cent yield. Nor could the loss of yield be pinpointed at this time to the metal, the dirt, the oil, the retainers, or the method of handling. But the improved performance was gratifying; 10,000 hours and more of life were achieved with successful bearings, thus justifying continued interest in ball-bearing gyroscopes.

A new problem then arose to add to those already generated by the demand for higher performance and longer life. The gyroscopes seemed to perform well for a day or two but then showed an increasing drift rate or bias change. This maddening problem, thought to be the bearings, proved to be electrical and was solved by modifying the operating technique to allow for cyclic momentary interruptions of wheel power. The interrupter technique is still used for certain conditions of operation and was recently used to good advantage by industry.

About 1955, a program under Air Force sponsorship produced data indicating:

1. The necessity of complete measurement of all bearing dimensions if accuracies appreciably greater than 200 microinches were desired.
2. The need for automated measurement of dimensions to eliminate operator judgment and insure repeatability.

In 1956 and 1957, further Air Force-sponsored work evolved the manufacturing methods and tooling required to make bearings to a 20-microinch tolerance on practically all race dimensions. (Balls were already good to 10 microinches.) This work also provided the automatic measuring instrumentation needed to check these micro-tolerances.

About this time, a Navy-sponsored program revealed that abrasives were left in bearings during manufacture. Techniques were developed for detecting and eliminating these abrasives, and this resulted in the virtual elimination of very early bearing failure (less than 100 hours). However, the elimination of abrasives did not materially affect over-all bearing yield due to the stringent performance requirements.

While the benefits of improved bearing geometry were being applied to bearings in operational gyros, a new bearing inspection tool was developed at M.I.T. This was a milliwattmeter-dynamometer designed to measure small variations in wheel power and so to verify the effect of the wheel power supplied on gyroscope performance. A "jag" appeared to be the commonly detected fault: the gyroscope drift and the milliwattmeter simultaneously jagged to an increased (or different) drift level and wheel power. This was an instance where it was easier to prescribe a cure than diagnose the ailment. It took several years of work at M.I.T., two M.I.T. theses, and contributions from A-C Electronics and General Motors Research to isolate minute oil-droplet motion as the source of the jags.

Retainer problems became critical when efforts were made to standardize the amount of oil in each retainer to avoid these jags. Normally, each retainer was impregnated with oil and centrifuged at 450 g's; the centrifuged weight was then compared with a previously obtained dry weight. The results indicated that oil retention varied from less than 1 per cent to 5 or 6 per cent of the dry weight; median retention was 2 per cent. Worse yet, a single bar of stock retainer material could yield the entire range of gradation. Even today, with the use of phenolic retainers, standardization of oil retentivity at about 3 to 6 per cent (depending on the user) is only accomplished by test and selection.

The problem of the retainer and the lubricant was akin to a man walking on a narrow board fence. He has only that thin line of board edges to tread upon; on either side of the narrow edge he falls off the fence. With the phenolic retainer, the narrow board fence represents success; but on the one side lies too much oil and oil jags and on the other side lies too little oil and short life. There were even numerous examples of falling off both sides of the fence at once, with jags and short life occurring simultaneously.

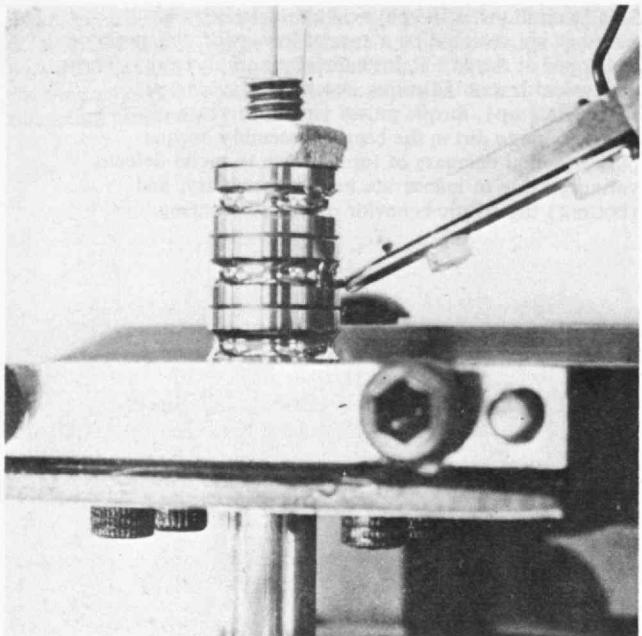
To a large extent, the problems were recognized for what they were. By screening clean bearings with a special low-speed dynamometer, prerunning for friction constancy, and testing on the milliwattmeter during prerun, short-lived, poor-performing bearings could be eliminated. However, all these tests further decreased the yield. Some change in the oil and/or the retainer, the bearing races, or the working surfaces was needed to give an acceptable balance between life, performance, satisfactory and reject bearings.

Phenolic and Nylon Retainers

The replacement of the cotton base phenolic retainer with the porous nylon retainer was the first step toward

Small variations in the physical characteristics of bearings are detected by a special low-speed dynamometer developed at the M.I.T. Instrumentation Laboratory. These are typical traces indicating acceptable bearing performance (top), torque pulses (initial increase of torque) due to dirt in the bearing assembly, torque pulses (initial decrease of torque) due to metal defects, variations due to inaccurate bearing geometry, and (bottom) the erratic behavior of a failed bearing.





M.I.T. engineers confirmed that precision ball bearings actually operate as fluid film bearings at high speeds after they designed and used this lubricant film electrical resistance gage.

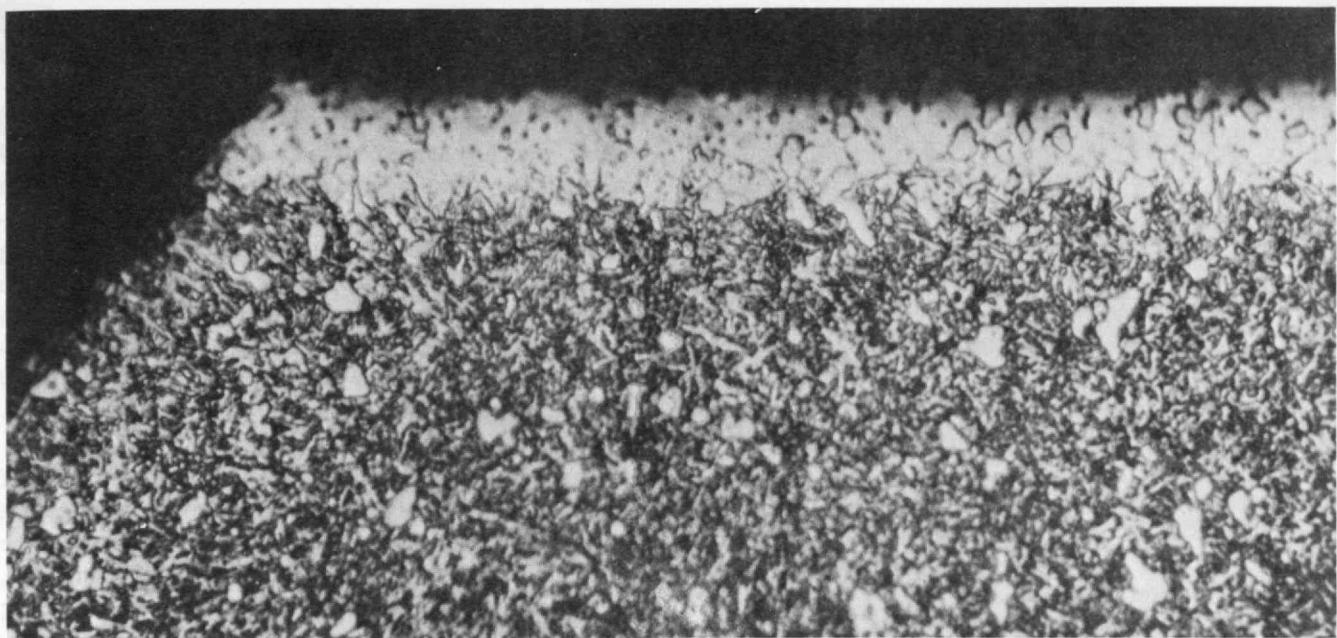
better life. The nylon retainer had its beginning in 1956-1957, when the M.I.T. Mechanical Engineering Department conducted comparison tests of a number of potential retainer materials; the tests showed a sintered porous-nylon material to be among the best but not equal to the then-used phenolic in terms of friction coefficient. In fact, phenolic is among the very best, if not the leader, in terms of friction coefficient. Still, the porous nylon showed promise.

Complete retainers using a combination of porous nylon and molybdenum disulphide were tried in bearings at M.I.T. in 1957. The performance on the milliwattmeter was poor and work with nylon was set aside. Nylon was then picked up by others with mixed results. Later an Air Force program at M.I.T. established reproducibility in manufacturing and revived interest in the material, but the nylon was plagued with surface effects and a subtle shrinkage problem. It remained for M.I.T. workers to point out that too high a porosity on the retainer-ball-pocket working surfaces could actually result in dry surfaces. The oil leaked away from the high-pressure side of the ball contact so that unlubricated metal retainer contact occurred. The surface problem was finally resolved by treatment of the machined surface of the retainer to close up many of the pores. The subtle shrinkage problem was found to be a closing-in of the retainer around the inner race and balls after assembly, stemming from the fact that the retainers were machined under relatively high-humidity conditions and used under low-humidity conditions; the cure for this was simple: control humidity during retainer machining. (Porous nylon shrinks about 3 mils/inch with each 1 per cent downward change in moisture content.)

Today, when gyro wheels are spinning at two to four times the old rate, the difference between nylon and phenolic retainer material is more marked—30,000 hours or more for the former with less than 2,000 for the latter.

Fluid Film Bearings

Gyro users have now become aware of some remarkable properties of ball bearings. The first intimation came from electrical resistance checks between the wheel and its stationary shaft. Before the gyroscope is started, this is very low, indicating metallic contact. At quite moderate speeds it increases until, at a few hundred r.p.m., a figure of megohms appears across the ball-to-race contacts, if we have good races. This means that an oil film forms in this narrow area, in spite of pressures of hundreds of thousands of pounds per square inch pressure. The rolling motion of the balls proves to be a much more powerful oil entrainment factor than any found in sliding type bearings where pressures seldom exceed a few thousand p.s.i. and usually fall below one thousand. The ball bearing, when properly made, is just as truly a "fluid-film" hydrodynamic bearing as any journal or inclined slider bearing. However, the film thickness is very much smaller, typically 10 microinches or less. This puts severe demands on the cleanliness, detailed race shape, and viscosity and chemistry of the



lubricant. If any one of these factors is deficient, the life of the bearing will drop to a few hundred hours in a gyroscope, where only minimal quantities of lubricant can be used.

Nearly all lubricants give equal film thicknesses at a given viscosity; silicone and perhaps polyphenylether are the exceptions, giving films not over one-fifth to one-eighth as thick as those of any other oil of equal viscosity. Much work remains to be done in discovering a requirement for a lesser minimal oil-film thickness because of improved bearing quality factors, inherently giving longer life.

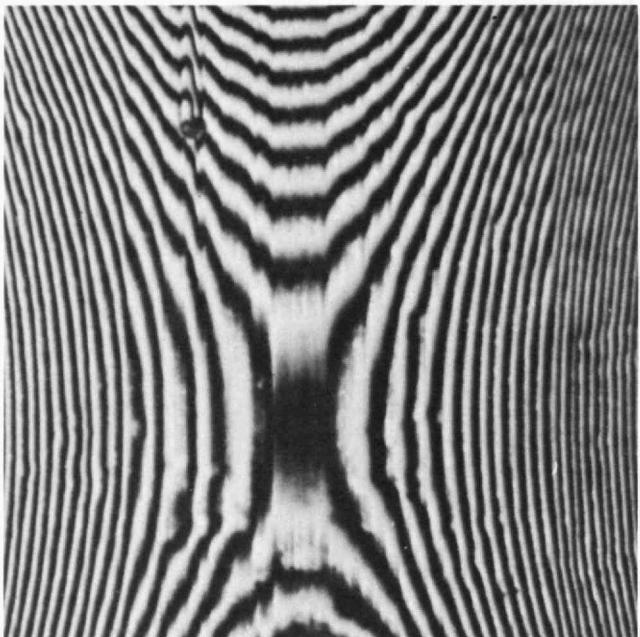
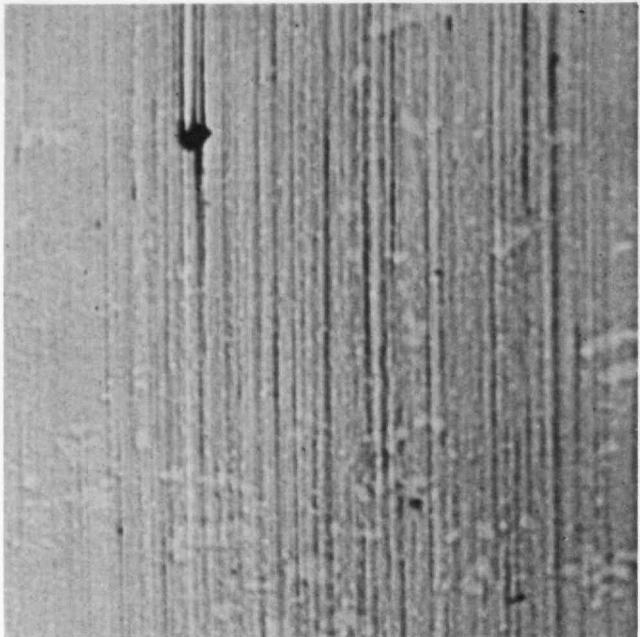
Oils impervious to higher temperatures, oxidation, and radiation must be found. We are in a nuclear age; motors must run and shafts turn in the presence of high-nuclear-radiation fluxes.

What appears at the moment to be only incidental information—but may prove vital in the future—is that lower operating temperatures (150 degrees F. and not 200 degrees F.) and elimination of oxygen in an absolute sense can enhance the life of mineral lubricants. However, the future may hold lubricants not affected by these factors. Certainly, such lubricants are definitely needed and must be sought.

Other efforts to preserve the fluid film have already resulted in considerable improvement, and work is continuing especially in the area of the ball separator, which serves as a reservoir for the lubricant. Use of a porous-nylon separator has resulted in a many-fold increase in bearing life, and future work is aimed at producing prescription separators for specific applications. Recent results of this program have indicated that aside from bearing life, gyroscope performance is related to ball separator dynamics. These dynamics are being brought under full control using speed, preload, dimensions, and materials as parameters.

What of metals? What is the best steel for bearing life, temperature, and surface pretreatment? This question is yet to be answered, although at M.I.T. today a

Heat-treating of steel for precision bearings is now coming under close scrutiny, and proper pretreatment appears to be helpful. But if environmental control is inadequate, heat-treating can result in such undesirable surface modifications as the change in the matrix material in the ring surface shown above.



Precision bearing makers sometimes find that steel is "a pot-luck affair," lacking in uniformity and full of nonmetallics. The pictures show an impurity in the bearing race and the "comet" of unremoved metal and debris which has formed in its wake during machining operations. The view with the interference microscope shows that the "comet tail" is actually raised above the surface of the raceway.

beginning is being made with several tool steels and stainless steels. Metallurgically clean steel is obviously most desirable.

It now appears that pretreatment of ball-bearing metal working surfaces by chemical and/or physical means can greatly influence bearing life. Electron photomicrographs of bearing races at 20,000x magnification show that coatings and pretreatment produce a smooth and bland surface, where before there had been all sorts of grinding and lapping marks.

Over-all progress has been significant enough to allow M.I.T. to design for 24,000-r.p.m. operation in its highest-performance instruments—something impossible only three years ago.

The quality of bearing needed to ensure this kind of operation with an elastohydrodynamic film will not be created by a jelly bean production line. These are some of the tolerances which are required: ball roundness, no more than three microinches variation in diameter; race groove roundness, up to 10 microinches in the radius of the circle involved; cross-race departure from a constant radius in the region of ball contact, 10 microinches; surface finish of the balls, up to one microinch; surface finish of the ball race grooves, up to two microinches; and added distortion to peripheral roundness when installed, due to poor geometry of races, shaft, or housing, up to 10 microinches. With tolerances such as these, an occasional detail of shape may be missed by even rigorous inspection. If it stands high enough to pierce the oil film, the result is rapid destruction of the lubricant and short life for the bearing. Great care and the proper selection of the finishing method are necessary if these features are to be completely eliminated. No damage to balls or race groove in the ball path area visible at 40x magnification can be tolerated.

Nothing mentioned here will be less expensive than its predecessor. The real question is whether the results can justify the cost. Today's ball-bearing gyroscope is a sophisticated instrument capable of accurate performance for at least 30,000 hours while lubricated by only a few milligrams of oil. The next generation may run for 50,000 to 100,000 hours, which will mean ball bearings that run from six to 12 years. Without doubt, this geometry is expensive and hardly describes a \$2 bearing; but remember that a multi-million-dollar spacecraft can be grounded for want of a bearing—or crash because a \$2 part fails. ■



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The New Challenge of Ocean Engineering

Systematic development of
engineering skills will bring
vast new resources within man's reach

By Alfred A. H. Keil

When the nuclear submarine *Thresher* sank in a great depth of water 200 miles off the coast of New England, it took many months of backbreaking effort before the wreck could be found and identified.

When a nuclear bomb fell into the Mediterranean off Palomares, after a strategic bomber and a jet tanker collided, it took nearly three months before the bomb was found and retrieved.

Last fall an oil rig in the North Sea, operated by British Petroleum, sank during a storm. Although designed to survive in very heavy seas, the rig that day encountered conditions far beyond the design specifications.

These three events dramatically illustrate that technology applied to the oceans is still in its infancy. Until this century, the challenge of the oceans has gone largely unheeded; conquering the ocean meant merely the ability to navigate the surface increasingly fast and efficiently. And even the advent of submarines has hardly broadened man's view of the seas, for they operate in a skin-deep layer—in a depth corresponding to only two or three times their own length.

The last five years, however, have seen the birth of a completely new marine discipline—ocean engineering. It derives from man's growing undersea activities, for exploration and for exploitation. Its realm is the design and construction of instruments, machines, and materials to overcome the natural forces of the ocean depths.

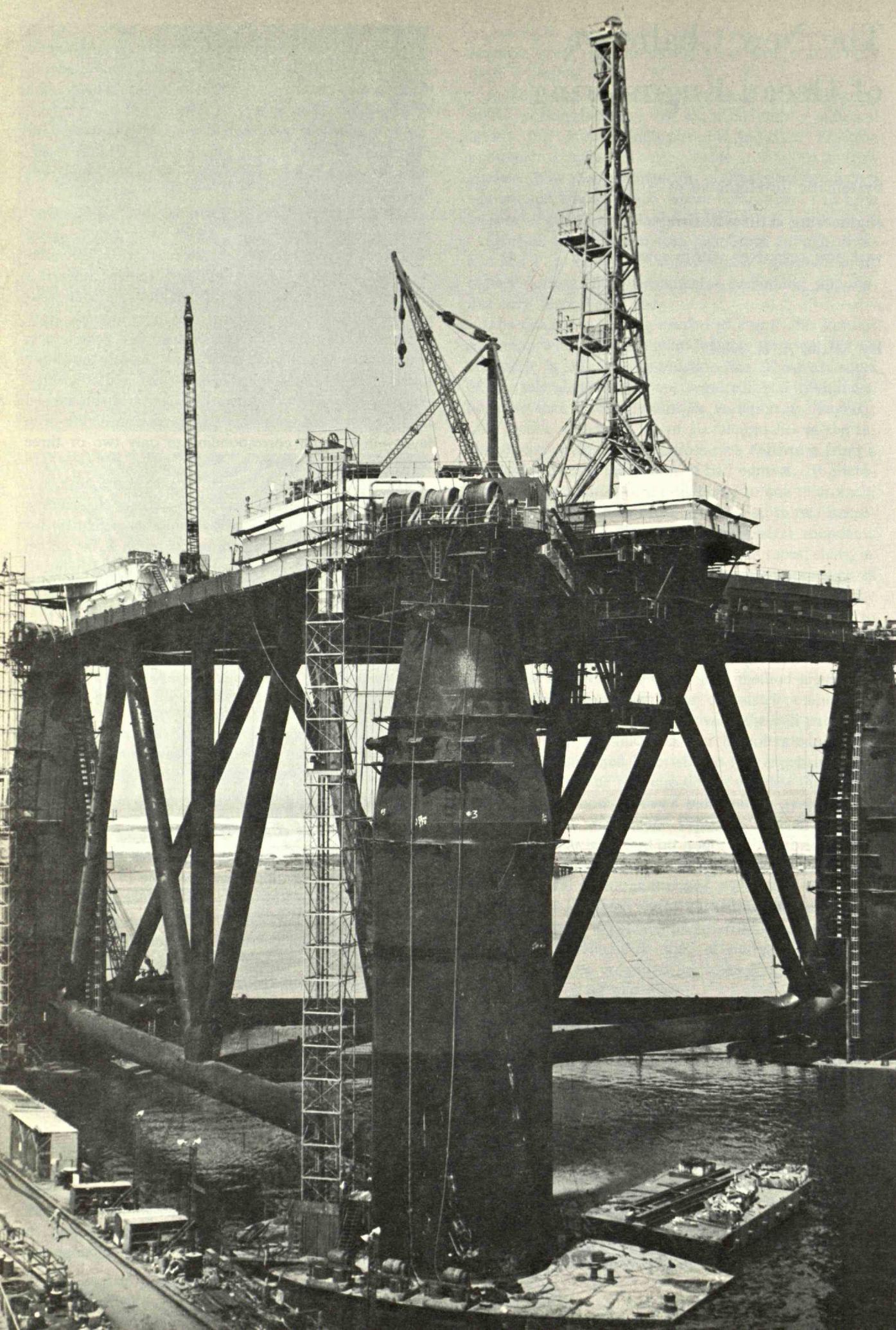
I must make it clear that ocean engineering is complementary to but not synonymous with oceanography. Oceanography is the scientific study of the sea in the quest for fundamental knowledge and understanding, and, especially in large-scale oceanographic experiments, depends more and more on technological contributions from ocean engineering. But the instrumentation of oceanography often moves far away from the marine environment—for example, many properties of the ocean can be measured from satellites.

The Fundamental Problems

National recognition of the need to utilize ocean resources reached the official level on June 17, 1966, when the Bill on Marine Resources and Engineering Development passed into law. This called for exploration of the oceans and the engineering developments necessary to "exploit" the resources the oceans offer. As key goals in this general program the law demands that we should:

- Expand knowledge of the ocean environment.
- Accelerate development of resources.
- Develop and improve vehicles, equipment and instrumentation for these two goals, and
- Advance education and training.

To understand some of the factors underlying the bill we must review the present state of the U.S. shipbuilding industry. Over the past 20 years, since its peak just after World War II, the U.S. has fallen from 2d to 11th place in the world in its volume of commercial shipbuilding. U.S. participation in ocean-going world trade in terms of tonnage of merchant fleet had dropped to about 12 per cent in 1965. U.S. tanker tonnage had



slipped from 55 per cent in 1945 to 8 per cent of the world tonnage available in 1965. And United States commitments in Viet Nam have diverted a considerable proportion of our commercial fleet from the normal trade routes.

Ocean engineering holds some of the answers to the challenge which today faces the shipbuilding industry. But to place ocean engineering in its true context I shall first deal briefly with its near relatives—ocean transportation and naval engineering.

Ocean Transportation

There is no doubt that the surface of the oceans will continue to provide the world's major trade routes. However, the last few years have seen a systematic change in ocean transportation; the shipping industry has begun to realize that this term implies more than just moving cargo from one port to another. Today, ocean transportation is understood to be an over-all system which comprises a broad view, based on market analysis and the complete problem of transporting goods from an inland terminal to another inland destination. Thus the interfaces between land and sea at the harbors become vitally important to the efficiency of the transportation.

A typical example of the success of this philosophy has been the rapid growth during the last few years of container shipping. Using containerized cargoes, which can be moved directly from sea to land transport, Matson Lines ships serving Hawaii have cut the time required for loading and unloading by 80 per cent. A similar approach, on a larger scale, is used in the concept of loading the cargo onto barges, which are floated to an appropriate port and loaded onto an ocean-going ship. At the port of destination they are floated out of the ship to continue their journey through inland waterways to the final destination.

The development of supertankers furnishes another example of the fruits of careful transportation and market analysis. For a long period the maximum size of tankers remained fairly stable, in the 10-30,000-ton range. In recent years, however, sizes have suddenly rocketed upwards; in fact, megaton tankers are now being seriously considered. This development stems from economic studies indicating that large tankers are much more economical than small ones for transporting bulk cargo, even when they have to unload offshore into pipelines and floating terminals. The new "jumbo" tankers have further benefited from streamlined production, re-appraisal of design methods and extensive use of automation when afloat. The recently launched 205,000-ton Japanese tanker, *Idemitsu Maru*, for instance, which was built in a few months, needs a crew of only 31 and contains only 3 per cent more steel than the 132,000-ton tanker, *Nissho Maru*, built in 1962.

To fulfill the demands for commercial ships of large displacement, designers and builders will have to update their techniques. In the future I foresee less custom-made shipbuilding and more emphasis on production engineering and standardization.

The application of computer-aided ship design will

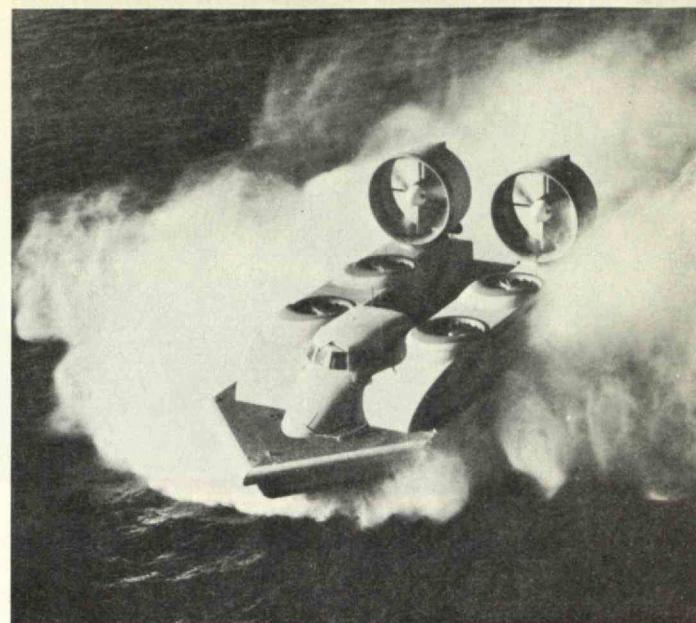


PHOTO: U.S. NAVY

Two new forms of surface craft now appearing in increasing numbers on the oceans. An oil rig now drilling in the Gulf of Mexico appears opposite; this can drill in up to 135 feet of water while sitting on the bottom, and in up to 600 feet of water while afloat. Photo above shows the SKMR-1 HydroSkimmer, an air cushion supported vehicle which can skim one and a half feet above the water at over 40 knots.

also force shipbuilders in this direction. However, it does give a compensating advantage: because of the potential of the large computer systems we shall be able to integrate the design and manufacturing processes, using numerical control in many time-consuming and costly operations such as lay-out and cutting of plates and assembly.

New Forms of Transport

Beyond the bounds of normal shipping, we see the advent of entirely new forms of surface vessels; two forms which typify the breakaway from orthodoxy are the hydrofoil and hovercraft.

The basic reason for switching from regular displacement ships to these new types is the search for increased speed. In general, a ship moving at the interface of water and air encounters essentially two components of resistance—a frictional resistance controlled by the wetted surface, and a wave-making resistance generated because the ship produces a surface wave which carries away energy. Thus, to obtain maximum speed one must reduce the area of the wetted surface and the production of surface waves. However, this is hardly possible on the regular displacement ships because, no matter how fast they move, they must be supported by buoyancy and displace their own weight of water. Thus the frictional, as well as the wave-making, resistance will always be present, even though the ship's underwater dimensions can control it to some extent.

To overcome this friction in the hydrofoil, a wing underneath the ship supplies lift. As the ship's speed increases, the foil gradually lifts the hull out of the water. Eventually, at a high enough speed, only the foil and

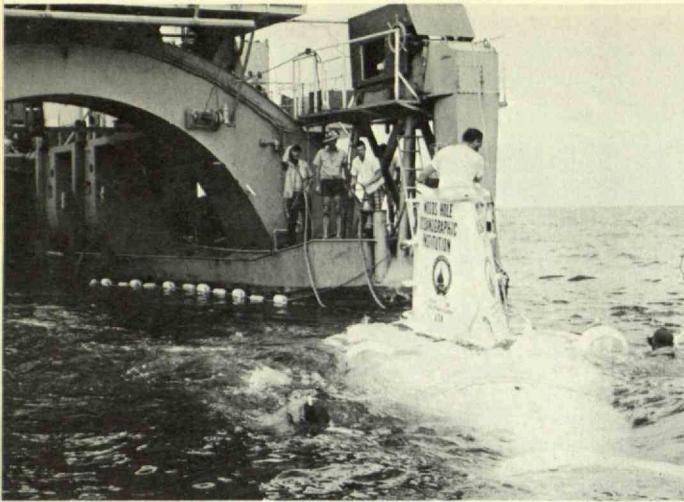


PHOTO: WOODS HOLE OCEANOGRAPHIC INSTITUTION

Three-man Alvin deep-sea exploration vessel leaves its support ship for an undersea mission. In spite of the development of sophisticated instruments, man is frequently the most reliable explorer of the ocean depths.

parts of the struts connecting it to the ship remain submerged. At these high speeds the ship encounters only the underwater resistance of the foil and struts.

The hovercraft takes the idea a stage further: an air cushion removes all parts of the structure from the water. Rigid side walls and bow and stern seals, or flexible skirts (in the British hovercraft), keep the air cushion in place. Even at high speeds the frictional resistance remains relatively small, as only the side walls or the skirt exert any drag on the vehicle's motion.

The wave-making resistance of hovercraft, which have much larger footprints than present ships of the same displacement, is relatively small at high speeds. When the air pressure lifts a stationary air-cushion vehicle out of the water the vehicle hovers over an indentation, because the air pressure also acts on the water. As the hovercraft starts to move, the indentation remains under it. As the craft picks up speed it tries to climb up and over the forward part of the indentation in the water; in other words, it tries to run up on its bow wave and ahead of it. Above a certain speed the wave-making resistance is rather low, since the vehicle moves too fast for the indentation to develop fully.

Hovercraft have already found commercial uses. They are used on a regular service between the English mainland and the Isle of Wight, and plans are afoot to use them for the channel crossing between England and France. They take part in operations in Viet Nam, have entered service in Canada to travel up rivers and shoot the rapids, and have also found many uses in the Soviet Union.

This, however, is only half the story. I believe that the air-cushion principle will realize its true potential when we apply it to large surface ships, to produce vehicles which can cross the oceans at 80 to 120 knots without being affected very seriously by the sea conditions. The Navy and the Maritime Administration have proposed a program of this type, and will soon be acting upon the proposal.

From the engineering point of view, these large-surface-effect ships are feasible with modern gas-turbine propulsion. Existing nuclear power plants are too heavy (in terms of the power they can produce) to be incorporated into such ships at present. However, the reduction in specific weight which will follow advances in design of nuclear plants may well make this form of propulsion practicable for large surface-effect ships. A decrease of just 50 per cent in the present specific weight will make this possible (compared with a decrease of 95 per cent necessary for incorporation of nuclear propulsion into aircraft).

When considering the ocean transportation of the future we cannot overlook terminals. One aspect of this is that large tankers cannot use harbors because of their draft. Today's harbors developed because they provided shelter for the ocean-going vessels of 100 to 200 years ago, and, in most cases, too, because they provided the only access inland via the rivers. If we had to develop harbors today these restraints would not bother us; we could—and probably now should—plan harbors in entirely different locations, in conjunction with new industrial and urban developments, providing the most efficient interfaces between land and sea transport.

The Challenge to Naval Engineering

A second factor which will become increasingly identified with ocean engineering is naval engineering. Reviewing the events of the last 20 years it may appear that further advances in this field are unnecessary. We have a fleet of mighty aircraft carriers, nuclear-powered for unlimited endurance, literally taking an airport to sea with landing fields, control tower, and repair facilities; accommodation and supplies for nearly 5,000 men; and fuel and munitions for the aircraft and their weapon systems. In the last 10 years we have seen the development of a Polaris submarine fleet which provides a striking example of imaginative and planned development and exploitation of advances in technology.

Why, then, should we think in terms of improving an already excellent branch of defense? Looking into the future, I believe that the oceans will become increasingly important to the defense of our country and our commitments overseas. With the proliferation of nuclear weapons, it seems to me more and more important to place deterrence power at sea, so that the population of the United States does not become the hostage of our deterrent strength.

Another important factor is that the major scientific advances in understanding the physical properties of the oceans have opened up the entire volume of the seas as possible sites of naval warfare. We need a determined effort to stay ahead of any potential enemy in all possible battlegrounds; this must include permanent occupation of selected parts of the bottom of the sea.

Of course, the Navy will also continue to benefit from refinements on surface craft. The development of large ocean-going surface-effect ships which can travel at around 100 knots offers a whole new realm of opportunities to develop an even more superior force.

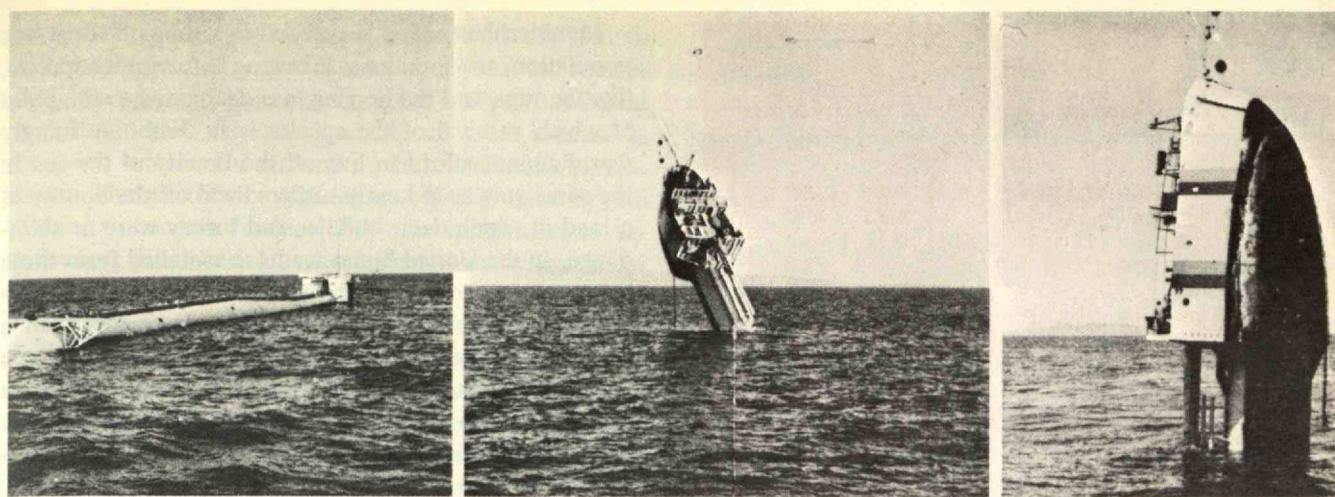


PHOTO: SCRIPPS OCEANOGRAPHIC INSTITUTE

The flip ship is an early member of a new breed of oceanographic craft. It is towed to a destination in the ocean, at which point the stern is flooded and 80 per cent of the ship submerges. In the "flipped" position the ship can serve as a center for deep-sea research.

Ocean Engineering

The problem of the Navy in keeping tabs on the world's oceans is no different from the problem of engineers attempting to use the oceans' resources: both factions must now recognize that all the water underneath the surface is at their disposal, as well as the surface itself. The challenge to ocean engineering is to produce vehicles fit to travel and work in this medium and to harvest its riches.

The oceans as well as the ocean bottoms are rich in mineral resources. While it is controversial whether it would ever be meaningful to extract these resources out of the ocean, that is, out of the water itself, the exploitation of mineral resources of the ocean bottoms is much closer to reality. Many of the mineral reserves for critical metals have been depleted in the United States to the point that we are almost entirely dependent upon imports to fulfill our demands. We import all the tin needed, more than 90 per cent of manganese, antimony, beryllium, and chromium ores, more than 85 per cent of our nickel and about 55 per cent of the needed zinc and lead. This, viewed in the context of the rapidly increasing metal consumption in the United States, establishes a pressing need to explore fully whether relevant mineral resources are available in the ocean bottoms off our shores, especially along the Pacific Coast and also along the continental shelves in our East Coast.

The most striking progress in utilizing these resources has come from the oil industry, which has been searching ever further offshore for oilfields. Through this venture it has developed a vast technology for drilling offshore and exploiting the newly discovered fields. Here we have a striking demonstration of a new area of naval architecture: the oil industry demanded new types of vehicles. The vehicles did not have, as in the past, the primary requirement of serving as a means of transportation; instead they had to be floating platforms, designed in such a way that they remain motionless in any disturbance in the sea around them. And so the industry has ended up with vehicles very different from ordinary surface trans-

portation vessels.

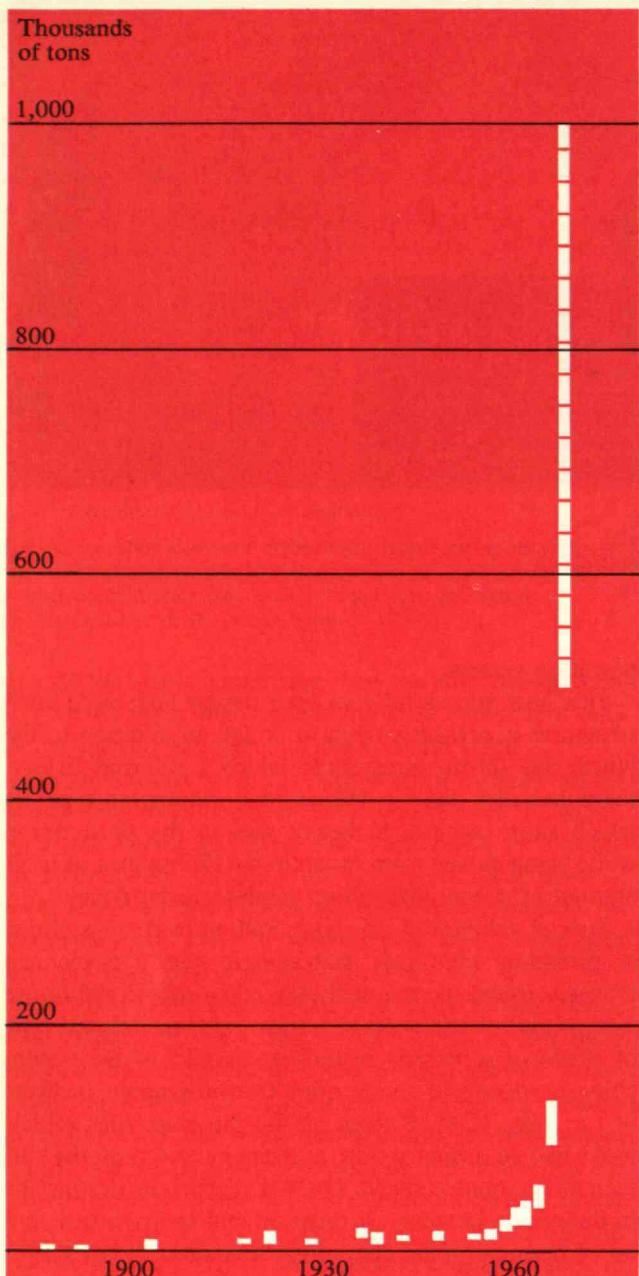
Just how successfully we can design and build such structures is presently open to doubt. In addition to the North Sea oil-rig disaster, to which I referred before, there has also been a failure of a catamaran-type rig which sunk recently in heavy seas in the open ocean while being moved from Japan to the Philippines. A large amount of ocean engineering remains to be done.

Special vehicles of this type, and other designs aimed at providing platforms that remain nearly motionless however rough the sea, will play a key role in the future exploration of the oceans' resources. One unusual type of platform is already in service, as part of the ocean-going hardware of the Scripps Oceanographic Institute at La Jolla, Calif. Known as the flip ship, this vehicle looks like an ordinary ship, and can be towed on the surface at reasonable speed. Once it reaches its destination in the ocean, however, it turns on end to become a center of oceanographic operations: the stern of the ship is flooded, and the bow rises out of the water until the ship rides vertically as a buoy, with 75 to 80 per cent of its length submerged in the water. In this position the flip ship can outlast almost any sea condition, because the heaving frequency lies outside the frequency spectrum of most waves that ruffle the sea's surface.

The present flip ship has a length of about 300 feet; larger ships of this type, which will be able to penetrate quite deeply into the ocean, have, in my opinion, potential as mother ships for oceanographic research, deep-sea rescue and search operations, and "sea-labs."

Exploitation and Utilization

Recovering minerals from the oceans themselves and gas and oil from beneath the bottom of the seas represents exploitation of existing resources, and we can obviously do nothing to ensure a growing supply. But when we turn to the plant life and protein resources of the oceans we must think beyond mere exploitation to creative rearing.



Size of oil tankers has increased dramatically this decade. The graph shows the range of sizes of the principal tankers built in selected years since 1880 and a forecast for tanker sizes in the next few years. The size of the largest tanker afloat today is 205,000 tons, but megaton tankers should soon start to traverse the oceans.

Mankind has nearly succeeded in killing off the whale population, and it may not take long before other species, like the tuna and the herring, are decimated to the point at which survival of the species is in doubt. A hungry world cannot afford to live off the bounty of the sea in the same way as the early settlers lived off the bounty of a land in which deer, buffalo, and turkey were in abundance. In the United States we have switched from these resources to controlled rearing of specially bred domestic animals—chicken, turkey, and beef—in less than a century. I foresee the time when we shall have to use the same approaches with the food we obtain from the oceans. Scallop and oyster banks provide a preliminary preview of this approach, but I am sure that these represent only the beginning.

What engineering challenges does controlled fish-rearing present? As long as we farm our fish in shallow coastal waters the technological and engineering requirements will remain fairly simple. But once we start to think in terms of the wide-open fishing grounds in the oceans—equivalent to the wide-open ranges of the West—and of the possibility of raising and controlling fish in these areas, many new, and at present only vaguely foreseen, problems arise.

To answer a few of these, I feel that we must ask such questions as: "Which valuable species of fish lend themselves to controlled breeding and raising in the ocean?" "Which ocean areas offer the best facilities for such ranches, and how can the natural food supply for the fish be augmented and controlled?" and "What are practical fences for selected species of fish?"

Perhaps we should start to experiment with various types of fence, such as mesh-type and air bubbles, in a preliminary effort to determine what would be meaningful ocean experiments. And in the end, of course, any solution will require support from ocean-going vehicles of one type or other—vehicles which in many respects will look quite different from what we now consider ocean-going craft.

Beyond the obvious and practical targets of utilizing known resources, new oceanographic frontiers exist, and we should now begin to think in terms of investigating the possibilities beyond these whimsical frontiers. One example of such an investigation would aim to determine how the large cavity generated by a nuclear explosion under the sea floor will react to the hydrostatic pressure, to discover how the heat the explosion produces will circulate, and suggest what practical uses such cavities could have. The depth for the explosion would obviously have to be chosen to prevent the escape of radioactive residue from the bomb into the ocean.

Engineering Support for Human Exploration

What is the current status of our effort to utilize the seas' resources? What is already the role of ocean engineering today? Except for the oil industry, the present climate is still really one of exploration, discovering precisely what riches the oceans can offer us, and how man can best obtain them. Experience during the last five years with deep-diving vehicles has clearly demonstrat-

ed that, in spite of sophisticated instruments, the human eye and brain still remain the most efficient instrument and data processor for oceanographic study. Thus Naval and commercial interests have shown great interest in deep-sea vehicles for research, search and rescue operations. The prototype vehicles are giving industry the chance to become familiar with new approaches to engineering. Engineering technology is just as much developed by designing and building as it is by carrying out the background research.

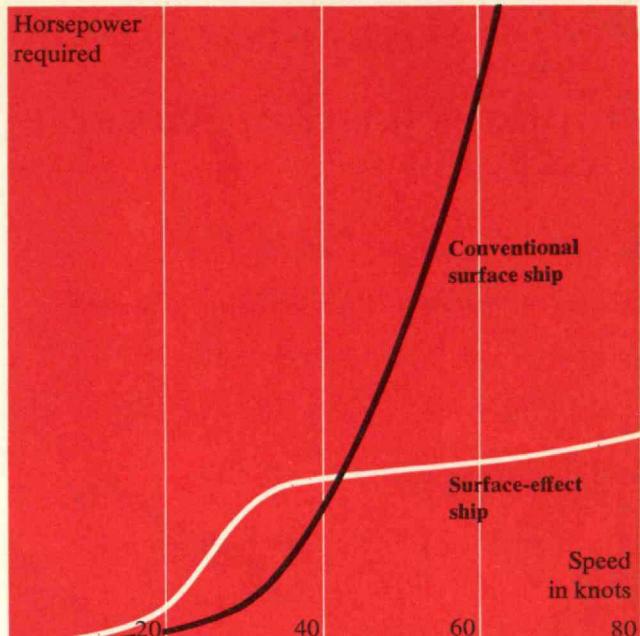
These examples typify the application of the systems approach to ocean engineering (and also to ocean transportation and naval engineering). No longer does the designer of a ship, an instrument or a full-scale project ask simply, "How do you design the best pieces of equipment for which the characteristics are established?" Instead, the first stage of any formulation is a searching quantitative analysis of the problem, "Which set of characteristics would assure that a piece of equipment designed to these characteristics is the best solution for the mission to be performed?"

The main challenge today is the design of suitable materials to withstand the corrosive marine environment. A typical example is the search for a material which can be used to construct pressure hulls for any type of deep-sea application. The Navy has conducted studies of this sort for decades in connection with submarines, but the impact of "deep submergence" has caused greatly increased activity in recent years. Since the range of application of such materials was extended beyond hulls for submarines, operating in relatively shallow depths, a broad attack has been launched on the materials problem. At present, steels, titanium and aluminum alloys, glass reinforced plastics, glass and sintered materials are being investigated; already some of them have paid off the research by becoming everyday constituents in ocean-engineering projects.

Other areas of engineering which require similar long-term study spring readily to mind—lightweight power plants for deep-sea applications and reliable underwater communications are two fields in which technological advances will benefit oceanographic utilization. Systematic development of these and many related engineering fields will eventually make available to man the riches residing in and below the world's oceans, and achieve the long-term objective of ocean engineering. ■



Alfred A. H. Keil came to M.I.T. in July, 1966, as Professor and Head of the Department of Naval Architecture and Marine Engineering. Dr. Keil received his doctorate degree from Friedrich Wilhelm University in Breslau, Germany, and arrived in the United States in 1947. He came to M.I.T. from the U.S. Navy's David Taylor Model Basin, in Washington, D.C., where he was the first technical director.



Power requirements for orthodox surface ships and projected hoverships at different speeds. Above about 40 knots the resistance encountered by craft riding on an air cushion in moving over the water, and hence their power requirements, remains significantly low; these craft can thus travel far more economically at high speeds than can conventional ships.

Radio Astronomy: Window on the Universe

Science and technology act in harness to produce instruments which can probe the outer reaches towards the edge of the universe

By James W. Meyer

In a space age when we expect soon to send instruments and even men to our planetary neighbors, we may lose sight of the fact that for a long time we have been using a most erudite space traveler—the photon. It alone has the ultimate speed: a few seconds to the moon, three to 10 minutes to the inner planets, and just over four hours to Neptune and Pluto are its transit times in our solar system. From there to the nearest star is a long jump even for the photon—over four years.

Until recently, astronomers used only those photons with energies lying in the visible region of the electromagnetic spectrum or close to it. Now we have opening before us what have been described as new windows on the Universe—vast new areas of the spectrum to which the earth's atmosphere is reasonably transparent. One of these is the radio region; here the atmosphere permits passage of photons with wavelengths from tens of meters to tenths of centimeters. This is the realm of radio astronomy, which—though still an infant—has made significant contributions to cosmology and to our understanding of our own galaxy, our sun, our neighboring planets, and our own atmosphere.

All this is very different from radar astronomy. For centuries astronomers have waited for the photons to come to them, have collected them with telescopes, and analyzed them spectroscopically. Now the radar astronomer can send out photons of his own choosing and study them to see how the target body has modified them as they return.

Contrary to the opinion of some, radar and radio astronomy are not incompatible. True, the radar astronomer sends out powerful signals in the radio spectrum used by the radio astronomer, but it is far easier for him to get sympathetic silence from the radar astronomer than from the host of other services crowding the available spectrum. Today, it is becoming increasingly commonplace for radio and radar astronomers to share the same facilities. In fact, radio and radar astronomy are quite complementary. Radar astronomy will be confined to the solar system for a long time. With its techniques astronomers may make accurate metric measurements

of the solar system, study planetary surfaces, deduce planets' rates of rotation and begin to understand processes occurring in the solar atmosphere. Radar astronomy also forms one section of our investigations of interplanetary matter.

Beyond the solar system—to our own and other galaxies and to the evanescent edge of the universe—radio astronomy has no competition from radar. And radio astronomers may be seeing the edge of the universe even now: some cosmologists believe that minute amounts of residual noise in the microwave region which have been observed recently stem from the edge of space and time—radiation from the primordial “big bang” that started our expanding universe.

A Fortuitous Beginning

Radio astronomy was born serendipitously out of a very pragmatic project—a study of radio noise in the high-frequency band, where some of the international radio-telephone circuits operated. Karl Jansky's perceptive analysis of data taken in the early thirties showed that some of the noise his directional antenna picked up was not originating on earth or in the atmosphere. It was apparently coming from some fixed point in space.

Today such a discovery would start an avalanche of investigations, but not then. Jansky, his project completed, was assigned to another. One man, Grote Reber, an ardent radio amateur, thought the discovery important enough to spend his own money and equip himself for similar observations. Reber was the first to use a parabolic mirror as a radio telescope.

Jansky had suggested that the noise he found originated in the thermal motion of a hot body—the vibrations in which all atoms at temperatures above absolute zero indulge. Reber therefore built his radio telescope to operate at the highest frequency within his means, where he correctly expected the greatest possible power (since thermal noise increases as the frequency becomes higher). His first attempts, in the region of 10 centimeters wavelength (an *astronomical* frequency in those days), failed completely. If the radiation he was seeking was thermal he should have had 26,000 times the intensity Jansky saw. A less tenacious man might have quit right there, but not Reber. He moved down the spectrum in decade steps until he achieved success at 187 centimeters. The “stubborn Dutchman” showed that the cosmic static which he and Jansky saw was far from being thermal in origin.

Reber began to understand that these non-thermal radio sources are strange indeed. Instead of increasing with frequency, as in thermal sources, the intensity of their radiation goes down exponentially as the frequency rises. Radiation from non-thermal sources has no discrete spectral lines; indeed, it has all the characteristics of noise, but not of thermal noise.

Towards the Quasars

These earliest radio astronomical observations took such a broad look at the sky that they saw no discrete sources at all. The radio telescopes were picking up, primarily,

the "galactic background" noise from our own galaxy, the Milky Way.

Just after World War II radio astronomers began to discover hot spots in the cosmic background. First, one emerged in the constellation Cygnus, then others appeared in the same constellation and in Cassiopeia, Taurus, and Sagittarius, as larger apertures and multiple antennas increased the resolving power of radio telescopes. The early techniques were not accurate enough to identify radio sources with visible stars. But as accuracy improved more and more of the radio sources came to be associated with visible objects, such as galaxies, supernovae, and nebulae. By the end of 1962 fifty-seven extragalactic radio sources had been identified with visible objects, and by the end of 1963 this number had increased to about 100.

Continuing improvements in positional radio astronomy led in 1964 to the discovery of a new breed of celestial object—the quasi-stellar radio sources, or quasars. These do not fit the pattern of regular radio stars and galaxies at all. They are sources of intense noise, yet have diameters of only 1 to 20 per cent of typical galaxies. One quasar, known by its catalog number 3C273, is bright enough to be seen with a good amateur telescope.

Optical studies of quasars have revealed large shifts of their spectral lines towards the red end of the spectrum. [Astronomers have observed the "red shift" for a long time, and they generally assume that it indicates movement of the body away from us. This has led to the concept of an expanding universe: parts of the universe are receding from one another at velocities that increase with increasing distances. Knowing this, and the constant of proportionality between velocity and distance (Hubble's constant), the amount of the red shift has been a measure of the distances of stars and galaxies.]

The spectral lines of quasars are shifted by as much as 46 per cent, which indicates that they are hurtling away from us at speeds up to 36 per cent of the speed of light. This places them between 10^9 and 10^{10} light-years away from us, distances at which we should never see an ordinary galaxy, let alone an ordinary star. How, then, does one account for the quasars' great radiation power, which enables us to see them? The fusion of hydrogen—the process producing energy in the stars—provides nowhere near enough energy to produce such radiation.

One possibility is that these quasars are not so far away after all, that the red shift may not result from movement. The theory of relativity tells us that a photon will lose energy—be shifted to a longer wavelength—when it moves against a gravitational field. But huge densities would be required to produce the red shift of quasars in this way. The presently favored theory suggests that the radiation and red shift of quasars result from cataclysmic gravitational collapse—explosions in the nuclei of galaxies.

Whatever the answer, the interest in quasars—on which radio and visible light astronomy combine as re-



PHOTO: GROTE REBER

Original radio telescope built by Grote Reber in 1937 with his own money and energy. As he put it, "In my estimation it was obvious that K. G. Jansky had made a fundamental and very important discovery." He built this 31-foot parabola after rejecting a bridge company offer to build and erect a 50-footer for \$7,000! In the mid-thirties Reber thought this price was excessive, but later wished he had been "more of a speculator."

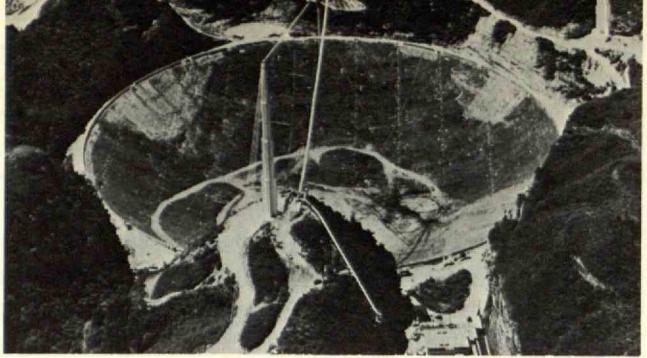


PHOTO: ARECIBO IONOSPHERIC OBSERVATORY

PHOTO: CENTRAL OFFICE OF INFORMATION

PHOTO: NATIONAL RADIO ASTRONOMY OBSERVATORY

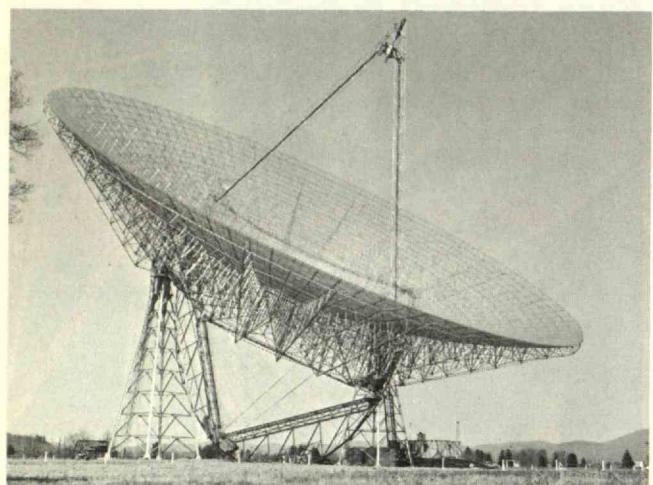


PHOTO: M.I.T. LINCOLN LABORATORY

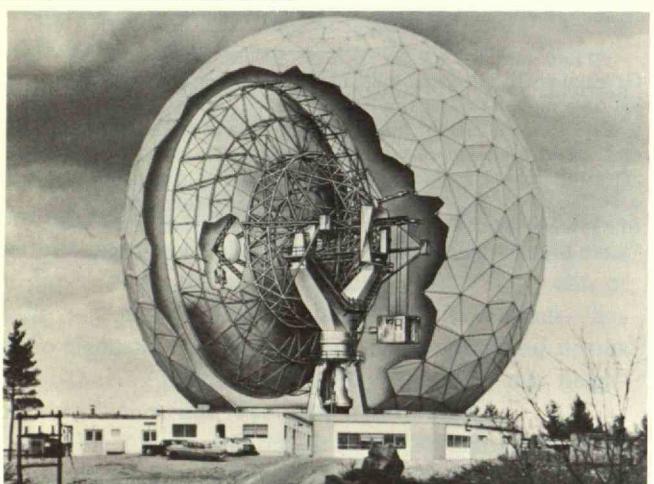
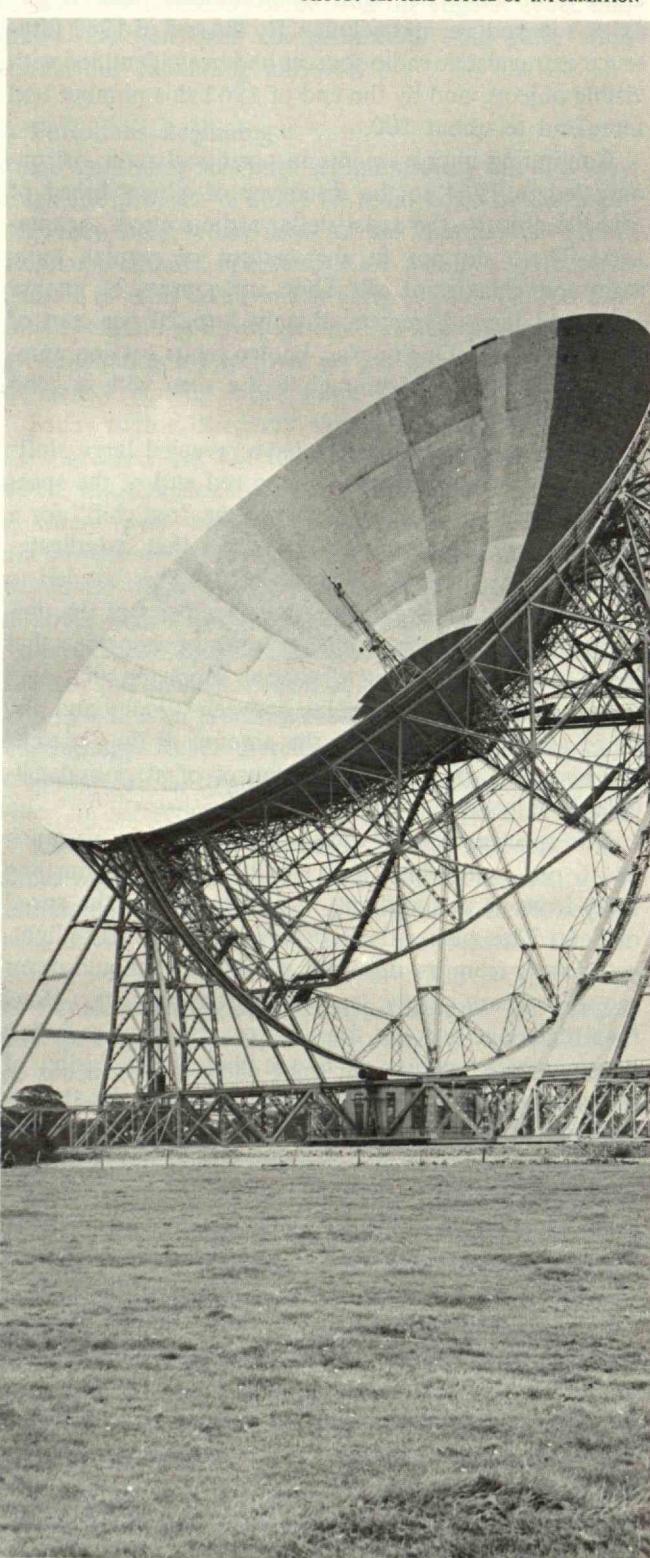
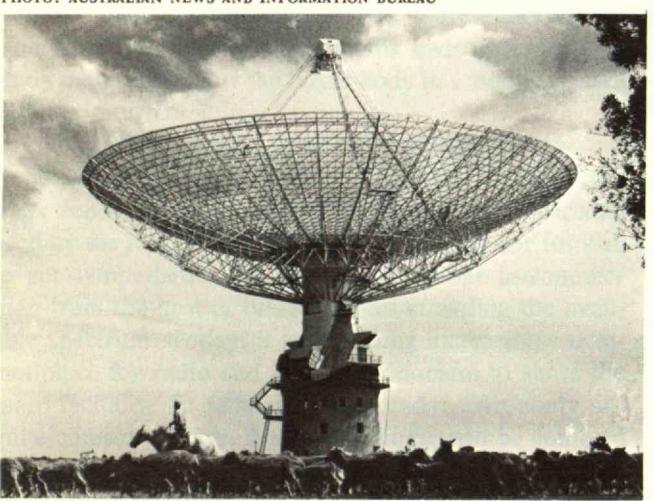


PHOTO: AUSTRALIAN NEWS AND INFORMATION BUREAU



Kaleidoscope of radio telescopes (left) shows five of the largest in the world today. At the extreme left, top to bottom, are the Greenbank, Haystack and Parkes telescopes; at near right, top to bottom, are the Arecibo and Jodrell Bank instruments. Chart at right indicates the performance characteristics of 10 of the world's largest radio telescopes. The leveling off of gain and the onset of reduced gain for shorter wavelengths is indicative of the precision of the parabolic surfaces in terms of wavelength of those large reflectors. The largest fully steerable telescope is the 250-foot diameter telescope at Jodrell Bank; neither the 1,000-foot diameter facility at Arecibo nor the 300-foot diameter Greenbank telescope is fully steerable. However, studies are underway in the United States, Britain, and Australia to determine the feasibility of even larger radio telescopes.

search tools—is now very keen. These objects, too bright to be stars yet too small to be ordinary galaxies, present cosmology with one of its greatest problems.

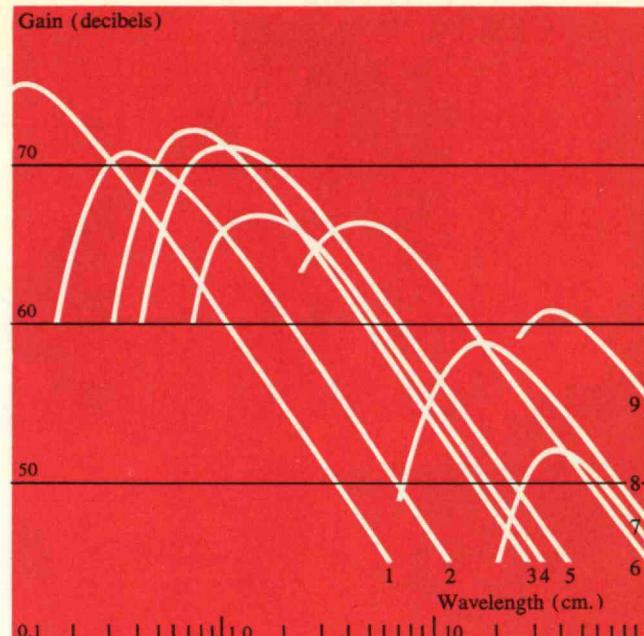
Molecules in Space

Until 1951 radio astronomers had to be content with observing the background, non-thermal radiation from space, interspersed occasionally by hot spots indicating powerful sources. In that year, however, came evidence of radio emission from hydrogen, and this was the key to impressive progress in the years to follow. Hydrogen showed itself through its spectral line at 21 centimeters wavelength, an electromagnetic wave resulting from very small changes in the energy of hydrogen atoms. Radio astronomers could now identify the most abundant element in the universe, which pervades the vast interstellar spaces in our galaxy. By measuring the red shift of this line they had a quantitative index of motion; they could compare radio and optical observations of our galaxy. And the results showed good agreements.

Vast clouds of dust obscure the optical astronomers' view of much of our galaxy. Microwaves penetrate these clouds easily, and study of the hydrogen line has given astronomers a first "look" at parts of the Milky Way. With the red shift to measure distance, and large telescope apertures to give good angular resolution, radio astronomers have produced radio maps of the unseen arms of our galaxy.

The hydrogen line can be observed either in emission or absorption. In producing emission lines, the hydrogen atoms themselves emit the radiation detected. But hydrogen atoms can also absorb radio energy at 21 centimeters; and so it is possible to infer the presence of hydrogen in any one part of space by the "hole" at 21 centimeters in the general background of radio noise. Absorption studies of the 21-centimeter line thus give information on clouds of hydrogen between radio sources and the earth.

As the sensitivity of radio telescopes improved and techniques were polished, radio astronomers looked hard for new lines. The obvious candidate to follow hydrogen was a line from heavy hydrogen (deuterium). So far, however, no one has seen this line, in spite of the fact that instruments are sensitive enough to detect concentrations of deuterium in space well below that corresponding to the ratio of deuterium to hydrogen on earth.



- 1 Aerospace—15-foot—and University of Texas—16-foot.
- 2 28-foot Spun Cast.
- 3 Lebedev—72-foot.
- 4 Good—85-foot.
- 5 Haystack—120-foot.
- 6 Parkes—210-foot.
- 7 Jodrell Bank—250-foot.
- 8 Greenbank—300-foot.
- 9 Arecibo—1000-foot.

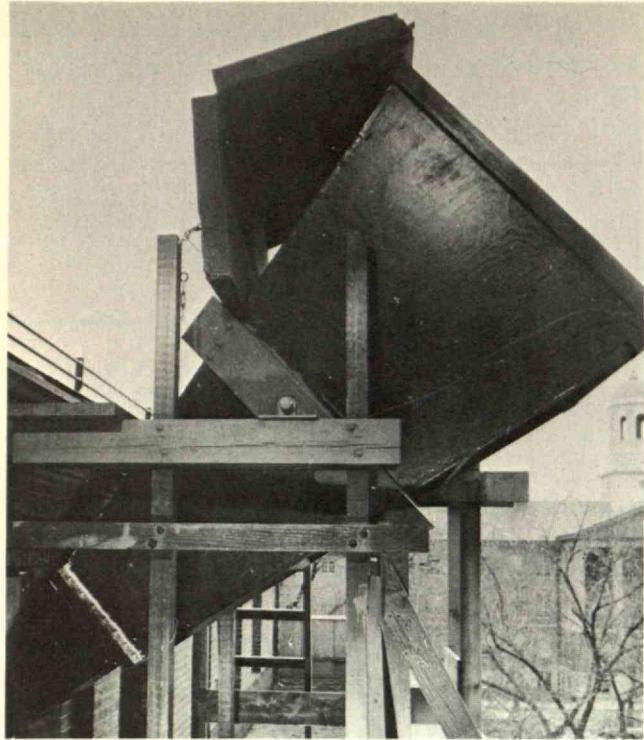


PHOTO: H. I. EWEN

Horn antenna, jutting from an upper-story window of a Harvard laboratory, collected the first evidence of radiation from hydrogen in space in 1951. The experiment was carried out by H. I. Ewen and Professor Edward Purcell. Studies of radio emission from hydrogen give us information about the unseen arms of our galaxy.

Finally, late in 1963, a group at Lincoln Laboratory observed two new lines in absorption: the 18-centimeter lines of the hydroxyl (OH) radical. Since then, these lines have been observed in emission. In certain regions they have very strange properties, such as high intensities and large amounts of polarization. These features have suggested to several astronomers that radiation from nearby stars must be producing a cosmic OH maser—the radio equivalent of a laser. At the moment, the whole OH story is in its early stages; it promises to be a most interesting one.

Only last year astronomers at the Harvard Observatory observed a new class of spectral lines in space. Extensions of formulae accounting for lines in the visible spectra of hydrogen and of helium predicted a series of lines in the radio region, and it is these that have now appeared. They have been observed in emission for neutral hydrogen and helium, and also for ionized hydrogen. Thus, radio astronomers now have the means of studying some of the highly ionized gases that make up our universe.

Radiation from the Big Bang?

None of the radiation I have described so far has shown characteristics remotely like those of simple thermal radiation. Recent observations, however, have suggested the presence of a residual thermal radiation which may emanate from the primordial fireball—the origin of the universe according to the Big Bang theory. The fireball was intensely hot and very opaque; its temperature might have been about 10^{10} degrees; its radiation, red shifted by the expanding universe over the evolutionary period, is expected to have a maximum intensity at a wavelength of about one millimeter.

Is there really residual radiation which can be attributed to the primordial fireball? "Fireball noise" presumably is identical to that coming from other sources contributing to the background radiation. It must be that part of the background that comes uniformly from all of space—that is left over, in a sense, after all the rest collected by the radio telescope has been accounted for. The problem is to sift the general from the total radiation that now clutters up (and makes interesting) the radio astronomer's life.

Here appears an opportunity to look into the really early days of the universe. Was it isotropic? Was it homogeneous, or did turbulence produce eddies and swirls? Or is that interpretation totally incorrect? What we need to answer these questions are data at wavelengths shorter than one centimeter. But in this region the atmosphere begins to become opaque. Is a radio telescope in space the answer?

Radio Sun and Radio Planets

Productive modern radio studies of the solar system belie the impression that radio astronomy's interest lies only in the remotest regions of space and time. Although Sir Oliver Lodge first searched for electromagnetic radiation from the sun at the turn of the century, it was not until the early forties that the sun was successfully

"seen" by radio. At that time British radars were experiencing some strange form of interference, and the investigator of this trouble correctly identified the sun as the culprit (rather than, as was originally thought, some novel manifestation of German jamming techniques). Had radio astronomy not begun with Jansky and been maintained by Reber, it would surely have blossomed now. The vast research effort put into radar contributed much of the technique and apparatus necessary to further radio astronomy. Now radio astronomy repays its benefactor in providing the designer of radio and radar systems with knowledge of the natural noise environment in which he must work.

The sun presents many faces as the wavelength of observation changes. At wavelengths near one centimeter the radio telescope sees a sun much like the one we see by eye, both in size and apparent temperature. At longer wavelengths it appears larger, much brighter at the limbs, and much hotter.

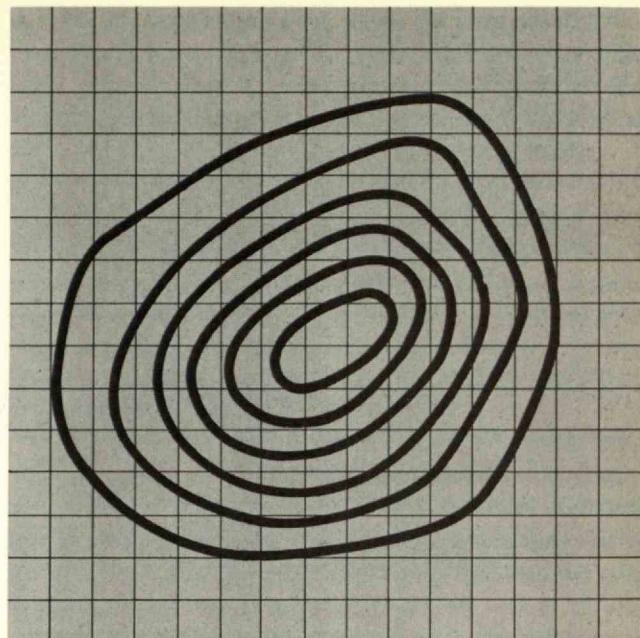
Most of the radiation from the quiet sun is thermal, but superimposed on this background are many different types of transient outbursts that make the sun's spectrum very complex. We have now passed the year of the quiet sun and are entering an era of increasing sunspot activity. Radiation of particles from the sun—the solar wind—gives rise to the radiation belts around the earth which represent one of the hazards to space travelers. Increased electromagnetic radiation is believed to precede solar outbursts, and solar radio astronomers are now trying to work out methods of observation and analysis which will enable them to forecast dangerous outbursts.

The sun also provides the heat which makes the planets and the moon thermal radiators. The first radio observations of the moon came in the mid-forties, and detection of the first planet—Jupiter—did not occur until the mid-fifties. By now, radio astronomers have seen all the planets except the outer trio of Uranus, Neptune, and Pluto.

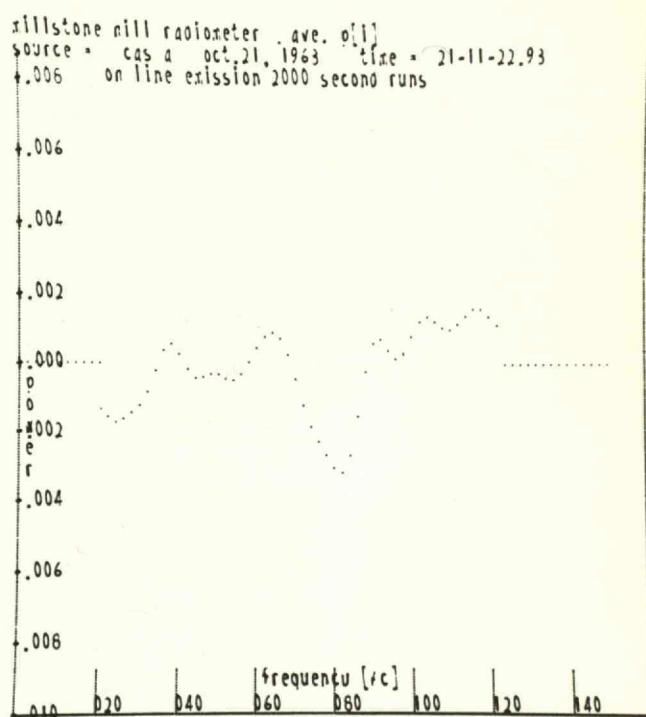
Planetary radio astronomy of course involves more than merely detecting the planets. Detailed analyses of radiation from the planets already detected have produced many surprises. Jupiter, for example, gives off bursts of non-thermal radiation in the decameter region and also radiates anomalously in the microwave region. Are these unexplained radiations Jovian counterparts of the earth's Van Allen belts? Thunderstorms? Plasma oscillations? Cyclotron radiation?

Radio astronomy has also given us a chance to peer through the clouds that veil Venus. Radiation at a wavelength of 21 centimeters probably comes from the planet's surface, while at intermediate wavelengths we observe different levels of the heavy atmosphere.

Thus a radio astronomical spectrograph provides useful clues to the identity, abundance, and distribution of molecules in planetary atmospheres and surfaces. By an adroit choice of wavelength we can place our radio thermometers in previously inaccessible regions of space—behind clouds, beneath the surfaces of planets, and in the various regions of the solar atmosphere. However,



Radio contours from a computer display show the pattern of radiation in the radio region from the Crab Nebula, whose optical radiation is shown on this month's cover. This nebula, the remnants of a vast explosion seen in 1054, radiates strongly at all wavelengths.



First evidence of the existence of hydroxyl radicals in space appears on this computer integrated display. A Lincoln Laboratory group made the detection, using the 84-foot parabolic antenna at Millstone Hill Observatory. The team consisted of Alan H. Barrett, Marion L. Meeks, and Sander Weinreb, '58.

Red shift
(ratio of shifted
to undisplaced
wavelength)

3

2

1



Relationship between the red shifts in the spectra of stars and galaxies and the velocities at which they are receding from the earth. The red shifts of the recently discovered quasars, such as 3C48, show that if indeed the effect is a Doppler shift, these strange bodies are receding at speeds comparable with that of light.

on earth we are limited by the boundaries of the radio window, between the ionosphere on the long wavelength side and the atmosphere at millimeter wavelengths. Radio telescopes in space would avoid these difficulties, of course. Indeed, in 1962 a microwave radio telescope aboard Mariner II looked at Venus from only 35,000 kilometers above its surface. Radio telescopes have also been carried aloft in balloons to study our own atmosphere.

Hardware for Radio Astronomy

It has often been said that engineering and technical progress depends heavily on the results of research motivated by the desire to know more of the basic nature of our physical world. But to stop there would do grave injustice to the great contributions that engineering and technology have made to our ability to undertake these fundamental investigations. Radio astronomy especially has profited from interaction between science and engineering, the one providing the why's, the other the how's.

The story of radio and radar astronomy is replete with examples of beating swords into plowshares. After the last war, German Wurtzburg radar antennas were pressed into service as radio telescopes. Microwave receiver techniques, urgently rushed forward by the needs of the war, became the backbones of microwave radiometers and spectrometers. Even today this interaction is taking place. Large microwave antennas designed for communications via the troposphere now serve as radio telescopes. A high-power tracking radar, designed at Lincoln Laboratory for problems connected with detecting ballistic missiles, now acts as a fountainhead of interesting radar and radio astronomy experiments. In fact, only recently have large antenna systems been designed specifically for radio astronomy.

Since the energy leaving a radio source spreads out over a spherical surface with the source at its center, the amount of energy that the radio astronomer detects depends on the strength of the source and its distance from the earth. Clearly, the effective area of the antenna collecting it determines the amount of power available to the receiver. In locating accurately the positions of radio stars, the resolving power of radio telescopes depends, as in the case of optical telescopes, on the diameter of the antenna in terms of the wavelength of radiation it is collecting. The Hale 200-inch optical telescope at Mount Palomar has a diameter of roughly 10 million wavelengths, indicating a resolving capacity of a few hundredths of a second of arc. Unfortunately, turbulence in the atmosphere limits earth-based instruments to resolutions around a second of arc, corresponding to a diameter of a hundred thousand wavelengths. The atmosphere probably imposes a similar limit on radio telescopes, but radio telescopes detect much longer wavelengths than their optical counterparts, and even instruments in planning do not approach this limit. Thus, while optical telescopes with greater diameters than those of the present generation would only gain a small increase in performance, radio telescopes

would benefit greatly from increased size.

One method, then, for improving the resolution of radio telescopes is simply to build larger antennas. Another is to use two antennas and measure the interference between the radio waves they collect. Among notable examples of this technique are the installations at Caltech's Owens Valley Radio Observatory and the University of Manchester's Jodrell Bank Observatory. The former has two 90-foot antennas, separated by up to 1,600 wavelengths, while the two antennas in the Manchester facility are separated by 75 miles; this equals 61,000 wavelengths, and allows resolution approaching a second of arc. However, there is always the danger of confusing the actual location of the source among the various possibilities in the fringe pattern that the interferometer forms. And for *sensitivity* in detecting very faint sources there is no substitute for the detector's collecting area; for interferometers this is the sum of the collecting areas of the individual elements, not the total area the array occupies.

Australian astronomers have applied another ingenious technique in the quest for improved methods of measuring diameters and positions of radio stars. This relies on the fact that the moon's orbit crosses some of the most interesting radio sources. By observing the radio source as the moon passes in front of it, astronomers can use the moon as a long-range reference of position. The method resembles watching a small source of light disappear behind the edge of a dime held two meters away from one's eyes. Unfortunately, the moon will never occult all the radio stars we might want to look at.

A radio telescope obviously contains more than just a large steerable mirror. It needs a detector—a sensitive radio receiver—and a method of recording and displaying the data. When one is searching for weak signals, the noise generated inside the detector itself plays the key role in the sensitivity of the system. The first stage of the receiver—the preamplifier—normally controls this self-generated noise; incorporation of so-called solid-state maser amplifiers into receivers has greatly improved sensitivities.

Finally we come to the radio telescope's presentation. Far from a picture of the heavens, this can take the form of a jagged trace on a pen recorder, a table of digits from a computer, or a contour map from a computer plotter. The digital computer is performing more and more functions in radio astronomy today, both reducing the tedium of data collection and expanding the horizons of presentation and interpretation of data. Special purpose computers now form integral parts of radiometers.

It may seem strange that a technology that can build glass telescope mirrors with surfaces accurate to a fraction of a wavelength of light should find it a great challenge to build a radio telescope mirror a few hundred feet in diameter. But in fact, problems in scaling size arise. Just as the strength to weight ratios of bone and sinew limit the size of the earth's animal life, materials limit the size in antenna design. We are used to designs which can flex under stress: airplane wings literally flap,

and skyscrapers sway in the wind. By contrast, the radio telescope mirror must be rigid, holding its parabolic shape to a fraction of a wavelength under the influence of changes in temperature and gravitational loading as the antenna is moved to point at different directions in space. For a radio telescope operating at reasonably short microwave wavelengths, this rigidity implies precisions of a small fraction of an inch. Every member in this kind of structure must contribute strength and stiffness. An added gusset, intended to stiffen a joint that flexes too much, may be just the wrong thing for the antenna: the added weight may produce more deflection than the added stiffness cures!

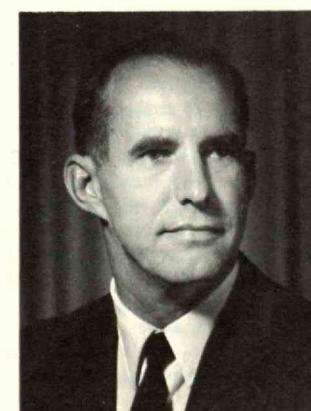
Lincoln Laboratory's Haystack antenna was designed and constructed under the surveillance of two computer-programmed structural analyses. The analyses, different in approach, were both used continually to cross-check the progress of the design, and the result was an outstanding performer. To blanket out the rigors of the New England weather, Haystack was enclosed in a radome; in more docile climes even the largest telescopes are unsheltered.

The Future for Radio Astronomy

Unlike optical telescopes, radio telescopes are nowhere near the ultimate limitations in performance imposed by the earth's atmosphere. A national committee has recently recommended the construction of a very powerful, high-resolution unit, and also suggested a large array of antennas, perhaps 100, each approaching 100 feet in diameter.

Beyond the ground-based frontiers are those in space, where the limitations imposed on long-wave radio astronomy by the ionosphere and on millimeter wavelength radio astronomy by the atmosphere do not exist. Orbiting radio telescopes will be able to peer unperturbed at the cosmos, using parts of the spectrum unavailable from the ground.

As in the case of elementary particles, unraveling the cosmic message that the wily photon carries demands large and expensive machines. Study of these space travelers tells us about the cosmos in much the same way that study of nuclear particles tells us about the atom's core. But no venture is quite like trying to penetrate the depths of space-time, and nothing will penetrate it quite as deeply as the photon. ■



James W. Meyer is senior scientist at the Educational Development Center (formerly Educational Services Incorporated) on leave from Lincoln Laboratory, working on films and other learning aids for undergraduate college physics. He joined the staff of Lincoln Laboratory in 1952; he has been associate head of the Radar Division and of the Solid State Division, and, from 1963 to 1965, was head of the Radio Physics Division.

Trend of Affairs

International Technology: Closing the Gap?

Technology is the most exportable of America's modern skills.

This is the capsulated conclusion of four M.I.T. Faculty members speaking on problems and opportunities of international business before a recent closed meeting of New England corporate executives sponsored by the M.I.T. Associates.

American firms have several advantages when they set up shop overseas. One is mobility, according to Charles P. Kindleberger, Professor of Economics, who pointed out that "the international corporation is going to be able to move (for example, to a new, more efficient location) more easily than, say, a German corporation could move to France."

Another is the antitrust regulation in some foreign nations. These laws, according to Morris A. Adelman, Professor of Economics, may serve to prevent locally owned competition from subjecting American-owned firms to price squeezes or market freeze-outs.

But there are problems, too. Europeans' pride and traditional nationalism makes them view with suspicion or even alarm "intrusions" from the new world. This sometimes develops into an outright refusal by a government to allow American takeover of a firm, said Professor Kindleberger.

The gap between the U.S. and any of its national competitors is wide and it is not narrowing, said Carroll L. Wilson, '32, Professor of Management. Why?

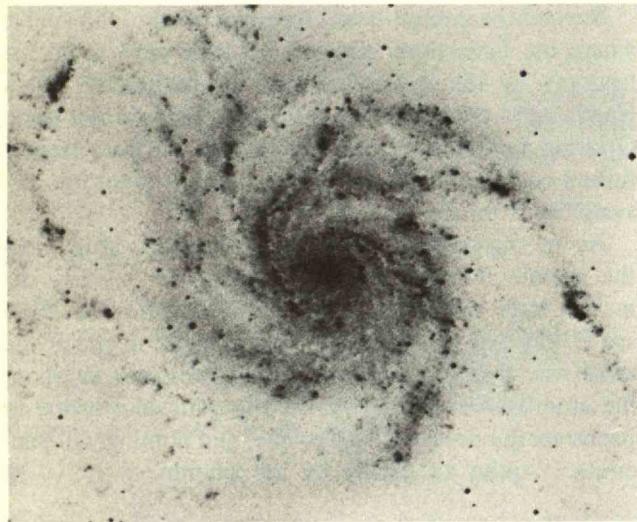
Because, he said, many European companies are hobbled by weak managements. "There are mental blocks that curb spending on research and development. Government support tends to go to government enterprises or to schools; there is labor immobility, too much secrecy, a desire to co-operate with competitors rather than compete with them. There are too many small, inward-looking firms in Europe," said Professor Wilson.

But the most important American advantage is technology, especially powerful in relation to underdeveloped countries. "The great markets of the future lie in Africa, Latin America and Asia," said Richard D. Robinson, '63, senior lecturer in the Sloan School of Management. The marketable products are the skills required to build, equip and manage modern industrial plants, and the sale of these skills is "likely to generate the highest return on investment," Dr. Robinson told the group.

Indeed, Dr. Robinson related the recent speculation of a Department of Commerce official that, under our export licensing regulations, an M.I.T. graduate traveling abroad should have a validated export license before leaving the country "in order to cover what he has in his head."

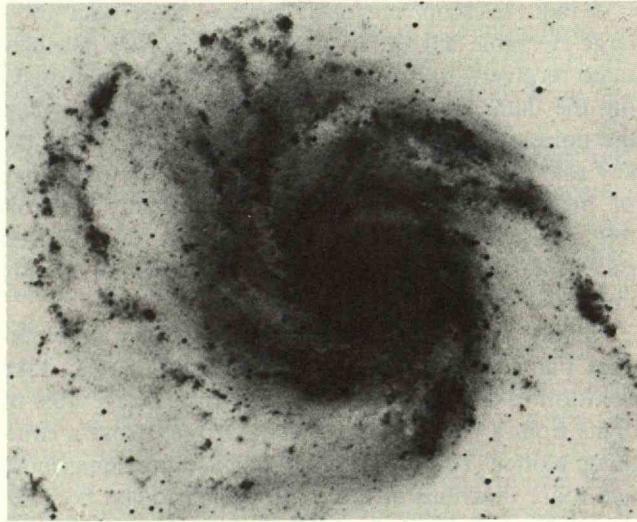
"A university such as M.I.T. is in fact an important export enterprise," Dr. Robinson said.

Technology can now be separated from production just as management was from ownership earlier in this century. The international corporation of the future will probably sell its technology, its skills, and its distribution services on a contractual basis to largely locally owned firms. "Under these circumstances," Dr. Robinson said, "private international business will probably



PHOTOS: WILLIAM C. MILLER, PALOMAR

A new photographic emulsion has enabled the world's largest telescope at Palomar to reach much farther into space and to record celestial objects three times fainter than any ever before recorded on film. Already the new emulsion has made important contributions to astronomy, confirming that small protuberances emanate from the starlike disc of quasar 3C-48. And it has shown that this quasar and another, 3C-273, are relatively isolated and not associated with distant galaxies. The details of the center of galaxy Messier 101 show up well in the conventional photographic plate (left), but its spiral arms appear in far greater detail on the sensitive new emulsion, which has here (right) captured stars never before photographed. The new material, developed by Eastman Kodak Company, emphasizes very faint objects against the glow of the night sky. It may be "one of the most significant advances in astronomical photography in a decade."



generate a net pressure in the direction of closing the gap between rich and poor nations. If so, its life expectancy is vastly increased." □

Our Poisoned Planet

The Annual Meeting of the American Association for the Advancement of Science conveniently fills the week between Christmas and the New Year with the illusion of hard work and the reality of a festive atmosphere. But the latest meeting, in Washington, took on a somber tone in considering the theme of "how man has changed his planet."

Pollution of all sorts dominated the discussions—pollution of the land, the atmosphere, waters, and cities, by pesticides, poisonous gases, organic and inorganic residues, and people. From the symposia came the message that we must act now to reverse the changes we have inflicted and are increasingly inflicting on our environment; it is not yet too late to ensure that in 10 years' time we will not be living in the equivalents of open sewers, but action must come soon.

Our environment has reached its present state of decay through the heedless application of new technology in past years. The lesson is now clear: introduction of a new technology without considering all its possible effects is, in the words of Elmer W. Engstrom of R.C.A., "equivalent to setting a time bomb that will explode in the face of society."

One novel idea for a fresh attack on the problems of urban pollution came from Professor Athelstan F. Spilhaus, '33, of the University of Minnesota. He suggested that an experimental city should be built, specifically planned to meet the problems of pollution and overcrowding which plague existing cities. Such a city would be an evolving body, and although computer simulation studies would help to solve its problems the fact that real people lived in such a city would ensure its authenticity as a model for cities of the future.

The most discussed urban-area problem was air pollution, and a number of scientists at Washington produced evidence that this is now having an adverse effect on even the agricultural environment. One speaker estimated that polluted air now causes more crop damage in terms of cost than the extremes of the weather.

Robert H. Daines of Rutgers University pointed out that pollution of plants was no longer restricted to small areas around notorious emitters; sensitive plants are being damaged over very large tracts of the country. We have the consolation, however, that plants are far more sensitive than animals to the sulphur dioxide and oxides of nitrogen which make up a large part of polluted air. Thus they can forewarn of the disasters awaiting us if we continue to poison our atmosphere.

A very practical application of this knowledge was described by J. R. Hansbrough of the U.S. Department of Agriculture's Forest Service. His group is breeding a series of Eastern white pine trees with specific sensitivities to different pollutants, and the trees will eventually find use as monitors of the type and extent of pollution in any region.

Another form of monitoring depends on studying air-borne radioactive materials attached to solid particles. These materials visibly affect plants, according to Ronald G. Menzel of U.S.D.A.'s Agriculture Research Service. And since the fact that a particle is car-

rying radioactive materials does not affect its physical properties, pollution scientists can validly use radioactive damage in plants as a monitor of the more general damage caused by polluted air.

Water pollution received its share of attention at the A.A.A.S. Up to now, scientists have concentrated on the problems of minimizing organic and biological wastes; however, two papers pointed out the potential menace of inorganic pollutants. Professor Jacob Verduin of Southern Illinois University noted the enrichment of phosphorus salts in U.S. waters over the last 20 years. The main source of this is effluent from sewage treatment; going back along the train pinpoints the real culprits as detergents which have not degraded. The excesses of phosphorus salts now building up are giving rise to dense populations of algae in waters.

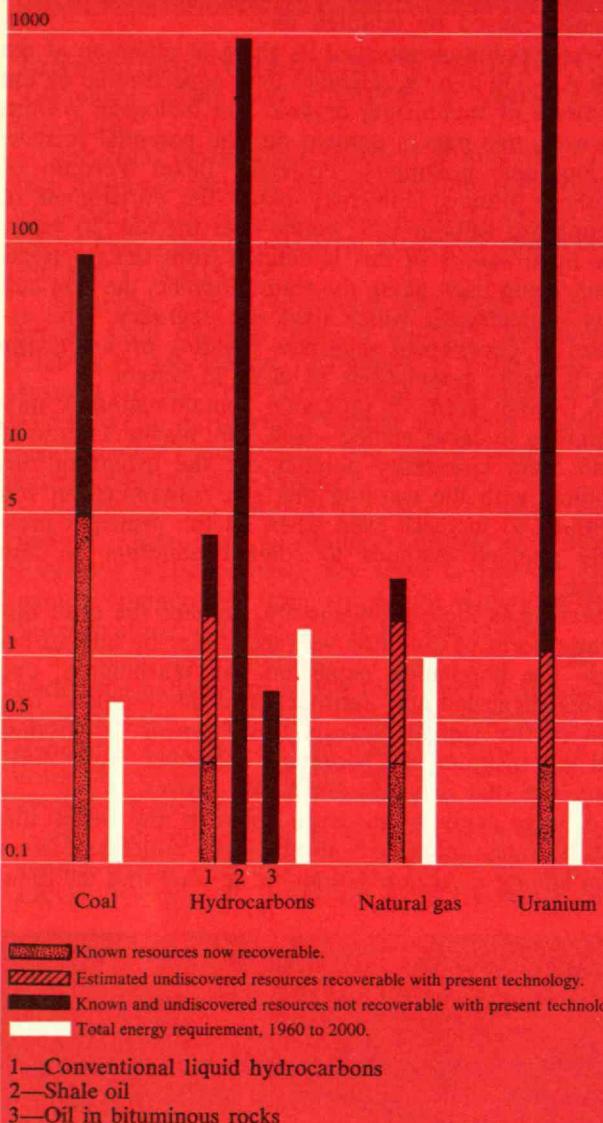
A second form of inorganic contamination is now beginning to cause anxiety—salt. Dr. Wayne Thorne of Utah State University pointed out the extent of this problem with the warning that salt contamination will continue to increase even when all the principal presently planned methods to combat pollution go into action.

Serious as these problems are, perhaps the most disturbing form of pollution we face is that by human beings—the population explosion. At Washington, two papers suggested new approaches to this problem. Ulia Olin of the United Nations Development Programme and the Institute of Theoretical Medicine, New York, suggested that urbanization is the answer.

A large body of evidence supports the belief that fertility rates among city dwellers are noticeably lower than among rural populations. It appears that the com-



The late Edward H. White, 2d, photographed on a visit to M.I.T. three weeks before his death in a fire on the Apollo launch pad at Cape Kennedy. In a statement about the tragic deaths of Astronauts White, Grissom and Chaffee, David G. Hoag, '46, Associate Director of the Instrumentation Laboratory, said: "We at M.I.T. are deeply stunned by the accident which has claimed the lives of the three astronauts. During the years we have been developing the guidance and navigation system for the Apollo spacecraft we had worked with all of them closely in Cambridge and in Houston. . . . All three made frequent visits to M.I.T., particularly Astronaut White, the senior pilot who was the crew member specifically assigned to guidance and navigation operations."



DATA: INTERDEPARTMENTAL ENERGY STUDY

Energy for the year 2000: Can research and development show ways to convert resources not now recoverable (black bars) to meet the world's energy requirements in 33 years (white bars)?

Trend of Affairs

petitive strain of living in a city reduces the ability and desire to have children.

The effect is particularly noticeable in Eastern Europe, where the total populations may well start to decline very soon. But whether urbanization can induce decreased fertility quickly enough to deal with the scale of the problem in India and other developing countries is open to doubt.

David M. Heer of Harvard University pursued another line of reasoning, proposing that the best way of stemming the population explosion will be to continue to decrease the death rate, using advanced medical technology. Dr. Heer has carried out computer studies of the factors which contribute to the high birth rates in developing countries. One of the assumptions he fed into his programs was that couples wished to make sure that at least one son would survive to support them in old age. When death rates are high, couples are physically unable to produce enough children to ensure this. At present, death rates are still just high enough to encourage high birth rates as insurance of a comfortable old age. But as the death rate continues to fall, according to the computer studies, the birth rate drops precipitously. Perhaps a faster way of assuring couples of care in their old age, suggested Dr. Heer, is to introduce well-publicized social security schemes in developing nations. □

How Adequate Is Our Energy?

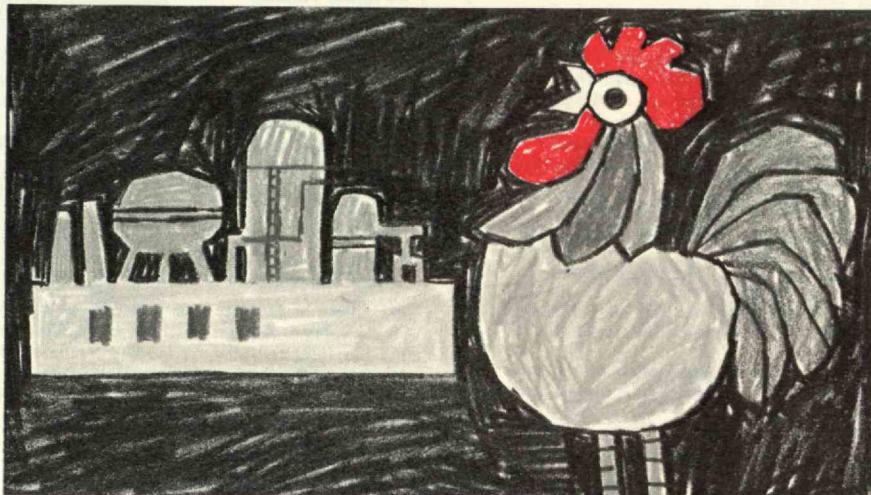
In February, 1963, President John F. Kennedy asked for "a comprehensive study of the development and utilization of our energy resources to aid in determining the most effective allocation of our research and development resources." Four years later Donald F. Hornig, Presidential science adviser, and Ali B. Cambel of the Institute for Defense Analyses have reported that "total resources" far exceed anticipated requirements for any and all energy sources . . . The fruits of research and development programs can assure economical and physically exploitable energy resources throughout the 20th century."

Coal supplies are far more than adequate for demands anticipated through the year 2000; liquid hydrocarbons (petroleum and derivatives) are in shorter supply, and the demand will probably result in cost increases. Natural gas is the energy resource of "greatest relative long-term scarcity." But there is "no serious long-term problem in the supply of liquid and gaseous fuels," because solid fuels can be converted and because of the immense reserves of oil shales ("one of the largest potential sources of energy available from fossil fuel") upon which we may draw.

The longer-range outlook is less certain. "For the period beyond the year 2000, these statements can be made with less and less confidence," says the report prepared for the Interdepartmental Energy Study by Dr. Cambel's Energy Study Group.

Additional research and development is recommended in several fields. Colleges and universities, said Dr. Cambel's group, already handle considerable energy-related research, especially in defense and space appli-

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PETER J. KAHN, Cornell University

Emphasis is on the development of mathematical insight and problem-solving capacity as the book proceeds from the specific to the general, the concrete to the abstract, the geometric to the algebraic. Illustrating this organization, the first chapter presents many examples informally, while later chapters supply theoretical foundation; determinants are presented as scalar changes in oriented volume due to linear transformation. Algebraic consequences are then developed. May.

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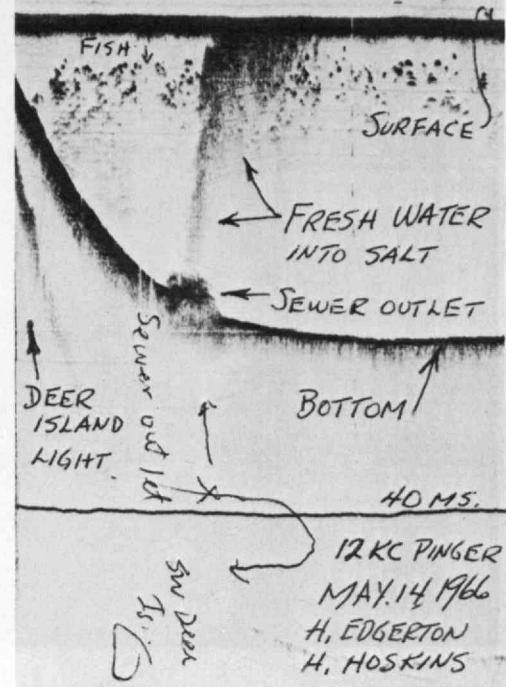
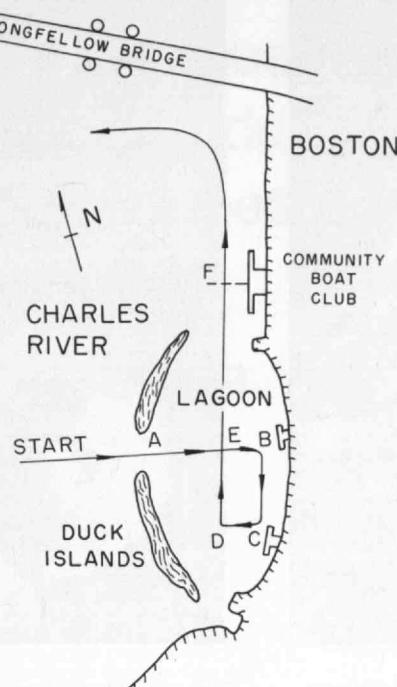
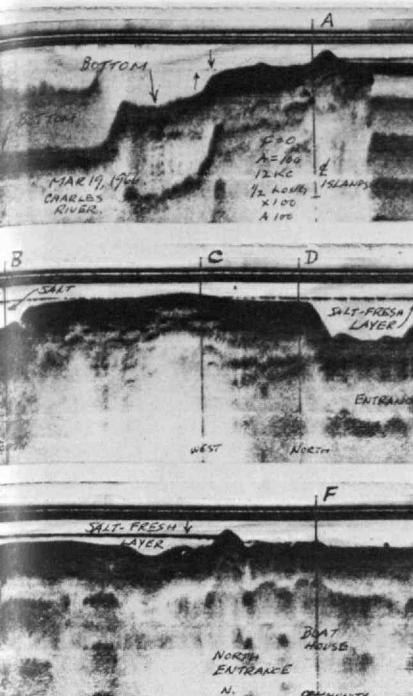
THE GENETIC CODE

The Molecular Basis for Genetic Expression

CARL R. WOESE, University of Illinois

A detailed discussion of the present status of the genetic code and the mechanisms for decoding genetic information. The conceptual history of the code is reviewed and various facets of decoding problems are considered. May.

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Sonar recordings of the Charles Basin. The map shows the route of the boat as it made the recordings. The unevenness of the interface between salt and fresh water may indicate either that clumps of flotsam or air bubbles are floating at the interface, or that the salt and fresh water are mixing over a short depth.

Extended interface between salt and fresh water above a sewer outlet in Boston Harbor. The sonar recording shows a column of fresh water rising from the outlet and drifting away with the tide.

Trend of Affairs

cations—areas which are “fashionable and exciting to the younger scientists and engineers.” But research on aspects contributing to civilian energy is not so popular; civilian economic growth is thus “deprived of the young, fertile minds and of basic research,” said Dr. Cambel’s report.

No single science today unifies energy, and the Energy Study Group urges that interdisciplinary programs should be set up to group “common aspects in the energy field.” □

Sonar Spots Fresh Water

Sonar has established itself as an important tool in the armory of deep-sea oceanographers, and it is also proving valuable in investigations below the sea floor. Now a new application has come to light—the detection of interfaces between salt and fresh water.

The Charles River Basin is one of the rare waterways in which interfaces of this sort occur. A dam between the basin and Boston Harbor controls the height of the water in the basin, and when the locks in this dam are opened at high tide, a large amount of salt water enters the basin. Instead of mixing with the fresh water, this flows underneath it.

Under drought conditions in summer, the layer of salt water so formed represents a large proportion of the water in the basin. The effect of the salt on the ecology of the river produces the characteristic smell of the Charles at this season. Not until spring does enough fresh water come down the river to flush out the salt.

In the December 23 issue of *Science* Professor Harold E. Edgerton, '27, describes a sonar exploration of the

Charles Basin (using a 12 Kc sonar with a pulse lasting 0.1 milliseconds) which clearly reveals the salt-fresh interface (see photo and map, above, left).

An interesting feature of the soundings is the lack of uniformity of the interface, as recorded. Possibly this means that clumps of flotsam or air bubbles are floating at the interface; alternatively it may stem from the fact that the fresh and salt water are actually mixing over a short depth.

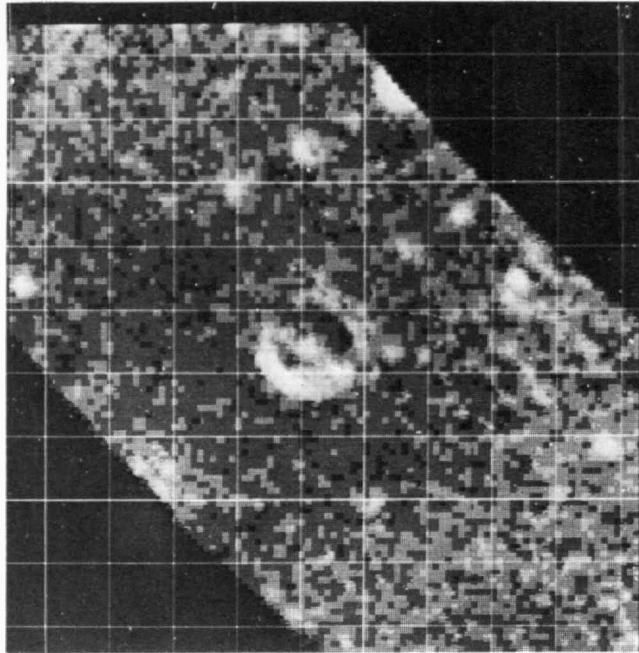
Can sonar offer any solution to the increasingly important problem of finding new sources of fresh water? Another sonar record (see photo, above, right) shows the interface between the cold salt water of Boston Harbor and warm fresh water pouring from the sewer outlet near Deer Island light. This picture suggests that the method could prove useful in pinpointing underground rivers, which empty fresh water into the oceans far below the sea’s surface. □

The Moon by Radar

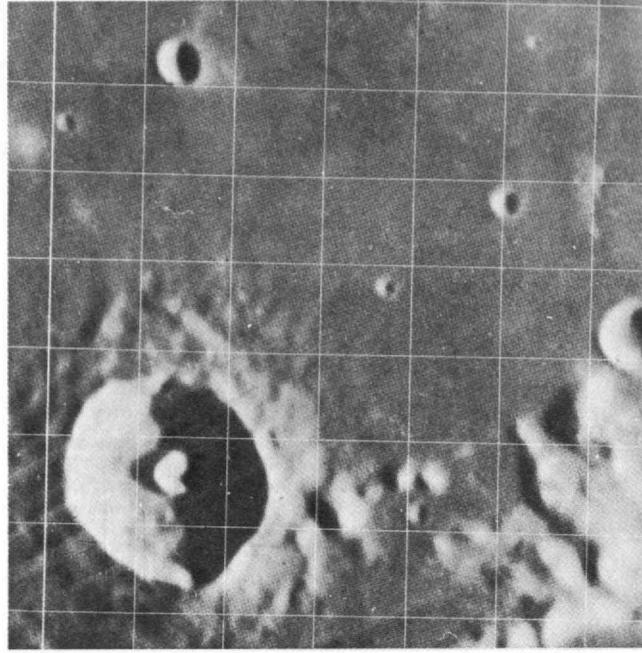
Do the Surveyor, Luna, and Lunar Orbiter craft, joined in a race to transmit close-up photographs of the moon, carry with their success a death sentence for the 20-year-old science of lunar radar? No, according to Tor Hagfors of Lincoln Laboratory. Studies by radar can still contribute to our knowledge of our moon. And the moon makes a fine testing ground for new radar techniques, developed to study the planets.

In a paper at the meeting of the American Association for the Advancement of Science last December, Dr. Hagfors pointed out how radar exploration has helped astronomers to build up a picture of the lunar surface:

- It has confirmed the view that the surface consists mainly of rather loosely compacted material, at least to a depth of many centimeters.



Two views of the Moon—a computer display of radar returns from the region around the crater Plinius (left) and an optical photograph of the same region (right).



The resemblance between the two photographs illustrates that radar resolution is now comparable with that of good optical photographs taken from the earth.

Trend of Affairs

- It has shown that on a scale of a few centimeters the surface is fairly smooth, undulates gently, and has typical average slopes of 10 degrees to 13 degrees.
- It suggests that a small-scale structure, probably rock-like, is scattered over most of the surface.

Dr. Hagfors referred to recent improvements in resolution made at the Haystack radar facility in lunar studies by Gordon H. Pettengill, '48. These have produced computer displays comparable in resolution with good photographs taken from the ground (see photographs above). And of course, the radar data contain far more information about the lunar surface than appears in the computer display.

Will lunar radar have any use once men have landed on and sampled the lunar surface? Dr. Hagfors believes that it will still be a useful tool for investigating unexplored parts of the moon's surface. Comparison between the astronauts' measurements and radar studies of the landing area will 'calibrate' radars and substantially increase the reliability of their predictions about the properties of unexplored parts of the moon and of the much more distant surfaces of the planets. □

Toward the Extinction of Junk

The ultimate plan to reduce society's pollution of its environment by waste and discard is to reuse everything, turning the consumer into a user who "rents" what he needs and in due course returns it for a reconstituted version.

To a limited extent this is already standard practice in the United States: milk bottles are returned for refills; much of our water is used, purified, and reused in a cycle that may repeat several times between raindrop and ocean; garbage is made into fertilizer which then

grows more food. Can this concept be carried so far that we achieve "total recycling"—with which there would be no such thing as waste and no pollution?

Athelstan F. Spilhaus, '33, professor of geophysics at the University of Minnesota, held that vision before an audience of skeptical scientists during the midwinter meeting of the American Association for the Advancement of Science. "Junk is a word that epitomizes the immorality and ignorance of *not* recycling," he said. "What we need is the step jump toward total recycling, control at the source, symbiosis of industry and massive experiments with entirely new technologies toward this end."

The automobile is the principal occupant of the nation's junk yards and therefore the most conspicuous example of the possibilities of recycling. It should be designed at the start with eventual reclamation in mind. The consumer really consumes nothing, for "he must eventually discard the same mass of material that he uses." The automobile industry, said Professor Spilhaus, could readily apply its far-flung network of operations to both distribute and collect, and its manufacturing process could be translated into mass-disassembly and renewal.

"With recycling," Professor Spilhaus explained, "the consumer becomes a user, which he has, in fact, always been. The concept applies to every piece of hardware that we use and presently throw away via the euphemistic 'trade-in' process. Complete recycling makes 'trade-in' real and meaningful," he said.

To economists who suggest that this is too expensive, Professor Spilhaus replies that "neither they nor anyone else know the staggering cost of our present waste mismanagement."

It is true that the cost of recovery far exceeds the value of the recovered material. But that is not the point. Recycling must be cheaper than dispersing goods as waste across the landscape and then cleaning them

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Warren M. Rohsenow, Massachusetts Institute of Technology, and Harry Y. Choi, Battelle Institute, Columbus, Ohio

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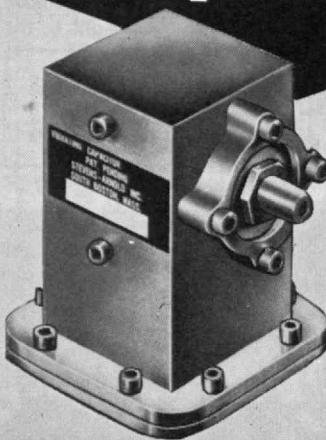
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up again in a totally unusable condition. "The purpose of recycling is not primarily the conservation of what we think of as natural resources; it is," says Professor Spilhaus, "the conservation of the one natural resource that we cannot re-invent once we destroy it: our natural environment." And who knows the high price of "the psychological insult to aesthetic sensitivity that even a perfectly sterilized junk yard presents?" he asks. □

For Science in the Colleges

The Alfred P. Sloan Foundation will give \$7.5 million to 20 liberal arts colleges over the next five years to strengthen their science education. It is the Foundation's largest appropriation for a single program in its 32-year history, a spectacular way to "sound the alarm over the danger to science teaching in the nation's independent colleges," said Fred M. Heckinger, education editor of *The New York Times*.

The problem, said the *Times* in an editorial, is "the magnetism of research-oriented and grant-favored universities," whose prosperity and opportunities make it "increasingly difficult for independent liberal arts colleges to recruit and retain first-rate young faculty members." The Foundation regards the 20 colleges selected as "demonstration" centers. "We hope," Everett Case, President of the Foundation, told the press receiving the announcement, "that the example of these colleges' thinking and acting to improve their science programs will be useful to other colleges with similar problems. Above all," he said, "we hope the grants will serve to release an increasing stream of supporting funds from private and public sources.

"We think that science itself will benefit by an increased association with the liberalizing and humanizing forces which have been traditional in the stronger independent colleges," Mr. Case said. "A stronger humanistic influence on science would be all to the good."

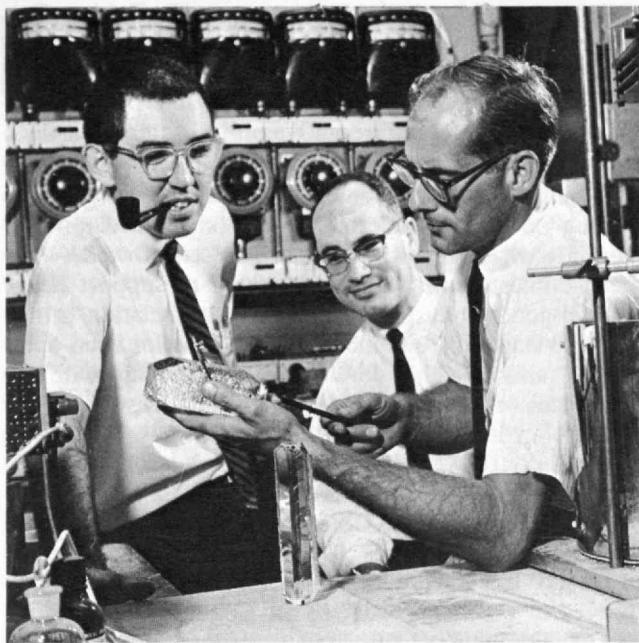
The Sloan money will be used by the colleges for post-doctoral fellowships, faculty "research" leaves, curriculum revision, new interdisciplinary activities, and the exchange of faculty and sharing of resources with neighboring colleges and universities—a plan which the Foundation regards as "especially hopeful." No funds will be used for building construction.

Among New England recipients are Middlebury (\$300,000), Mt. Holyoke (\$375,000), Smith (\$250,000), and Williams (\$500,000). □

After Viet Nam a New Opportunity

Has the United States, now deeply involved in fighting the war in Viet Nam, any clear plan for the political and economic future of Asia, once that war has achieved its purpose of containment? Is such a plan really possible in the face of current turmoil and uncertainty in Red China?

China's present insecurity is indeed one of two factors which give the United States new and timely opportunities to develop a truly coherent approach to Asian problems, according to Lucian W. Pye, Professor of Political Science at M.I.T. The other factor is the



An improved method which yields man-made crystals good enough to replace natural quartz crystals in all communications devices has been developed at Bell Telephone Laboratories and the Western Electric Company. Until now, synthetic quartz crystals—used extensively in filters, oscillators, and other communications devices—could not be used in oscillators operating at high frequencies, in frequency-control resonators, and in other devices requiring very precise and stable frequencies. The inventors are Robert A. Laudise, '56, left, and Albert A. Ballman, right, of Bell Telephone Laboratories and David W. Rudd (center) of the Western Electric Company.

growing economic pressure for international cooperation among the Southeast Asians themselves.

Writing in *Foreign Affairs* for January, Dr. Pye said that the United States should lead in establishing "a new Asian system of inter-state relationships," which will make "unmistakably clear what kind of Asia it is to which China must adjust." Then, he wrote, we must "mobilize the rest of Asia to convince the Chinese that they can find security in such an Asia."

China's increasing isolation from Russia and the evidences of internal insecurity combine to demonstrate to China and especially to the world outside that vast Chinese power and unity are illusory. "The current upheavals will accelerate the day on which Chinese Communism will have to give up its pretensions and come to terms with the realities of Chinese resources and the basic facts of Chinese society," wrote Dr. Pye. "For American policy this means that we should have firm confidence that time will bring moderation in China," that the Chinese will be unable to realize their forecast of "people's revolutions" in the developing areas of Asia. Instead, there can now be greater assurance that the Southeast Asians themselves with free world help can determine their own future.

The Asia for which we can now plan, wrote Dr. Pye, is already moving toward some form of co-operative effort, and American policy must be to capitalize on this development.

One "almost certain" consequence of the Viet Nam war will be a "massive infusion of American economic assistance to Southeast Asia," and this in itself will be a powerful stimulus to co-operation among the small na-

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Trend of Affairs

tions of the area.

But Asian nations are now beginning to realize for themselves, Dr. Pye wrote, that there is "an absolute ceiling on their prospects for economic development" within each one's own national markets. Instead, they need domestic markets large enough to support heavy capital-goods industries. This new appreciation is setting the stage for "significant forms of regional co-operation," and it is this development, coinciding with the evidences of weakness in China's position, which gives U.S. policy its special opportunity. □

Engineers and Selective Service

While a University of Chicago conference was finding the U.S. Selective Service system wanting in many key respects, Engineers Joint Council in November approved a "position paper" of the Engineering Manpower Commission which largely endorses the present Selective Service laws.

The statement approved by EJC praises the present law for its "flexibility" in meeting the nation's changing needs. An "arbitrary system such as a lottery" is opposed because it would be inflexible without necessarily providing more equity. "Men should continue to be deferred or drafted solely in accordance with the national interest," says the statement.

"Because the supply of engineers is now and promises to remain short of the nation's total needs," says the position paper, "the Engineering Manpower Commission believes that the national interest is best served by assuring that the . . . entry of engineers into the Armed Forces be limited to the numbers actually needed for military engineering functions."

"Only in this way," says EJC, "can the limited supply of skilled engineering manpower be utilized to meet the valid needs of the Armed Forces, defense industry, and the civilian economy."

College deferments, the EJC points out, are temporary postponements of military obligations, not exceptions from service. Under the present law, EJC says, "college students and graduates in the liable group are subject to draft as the national interest may require."

Though it offered no formal conclusions, the University of Chicago-sponsored conference seemed to conclude that deferments of college students have not only failed to serve the national interest but have actually penalized both students and colleges. The colleges come under pressure to qualify students for continuing study and the students themselves experience distracting pressure and artificial competition. □

Temperatures at High Altitudes

Measurements of temperature are difficult to perform at the best of times, but those at altitudes above 30 kilometers are plagued by systematic errors. Little reliance can be placed on single measurements, and the standard temperature curves which appear on meteorological charts are actually the averages of many measurements over the years. But a study completed recently at M.I.T. could greatly improve the accuracy of measurements from rocketsonde launches.

Donald C. Thompson, formerly a research assistant in M.I.T.'s Department of Meteorology and now a member of the New Zealand Meteorological Office in Wellington, carried out a study of bead thermistors under contract from Air Force Cambridge Research Laboratories. The bead thermistor is a small round object, consisting of semiconductor material, whose electrical resistance varies with temperature, with electrical connections at each end. In spite of its lack of accuracy, it is one of the most common devices used to measure temperatures at high altitudes.

Dr. Thompson analyzed experimentally the many errors that these devices encounter in operation, and also established calibration methods for the instruments. Among the main causes of inaccuracy in the temperature readings, Dr. Thompson found aerodynamic heating, motion of the rocketsonde (on which the thermistor is mounted) through the stream of air, the influence of the thermometer's surroundings on heat transfer, and simple solar heating. Minor errors in measurement result from the conduction of heat from the thermistor supports, the lag in the thermistor's response, and the current that measures the response.

Most of these errors tend to give readings higher than the actual temperature, and Dr. Thompson has calculated corrective factors to be applied to readings over a range of altitudes. The largest single correction stems from the effect of aerodynamic heating.

Combining all the various corrections for each five-kilometer interval of altitude, it proves that a five mil aluminized thermistor (with a 1.5 centimeter long lead) requires a correction to its readings which varies from 0.4° C. at 30 kilometers to 23.2° C. at 65 kilometers.

In addition to producing the calibration data, Dr. Thompson has suggested improvements in the basic design of bead thermistors. In his report he mentions that it is unfortunate that a more thorough study was not made earlier, since this could have improved the accuracy of the data from hundreds of rocketsonde launches in the past.

The Coming Age of Weather Science

The growing maturity of the atmospheric sciences will soon give man a truly comprehensive understanding of his weather and climate—and perhaps the awesome power to alter them.

Four scientific and technological developments lead to this promise of growing knowledge of weather and climate: mathematical models are now available for simulating natural weather processes, and high-speed computers will soon make possible extension of these models to very large-scale problems; satellites and other new ways of making remote observations of weather conditions are increasing to essentially global our information on current weather conditions, and new statistical procedures are making it possible to use these observations to establish cause-and-effect relationships.

These four advances, Thomas F. Malone, '46, Vice-president of the Travelers Insurance Company, told members of the American Association for the Advancement of Science in Washington in December, "set the stage for a rational era in weather modification. Quite clearly, within the next decade or so, it will become possible to explore through simulation techniques an almost unlimited array of deliberate interventions in nat-

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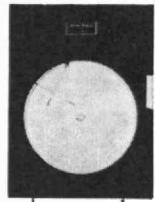
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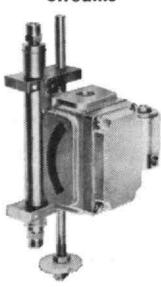
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Trend of Affairs

ural atmospheric processes and assess possibilities and limitations."

Though tremendous energies are apparently involved in all weather phenomena, Dr. Malone said, two factors give some reason to believe that deliberate weather modification may be possible. The atmosphere has an intrinsic tendency toward instability, he pointed out, and small processes at the interface between atmosphere and earth have a key role in determining energy inputs. It may indeed turn out, he said, that large effects can be produced "from relatively modest, but highly selective, human interventions." In our studies of these possibilities Dr. Malone declared, we must "forthrightly recognize the atmosphere and the benefits it brings to be a resource shared by all nations . . . If one day we may be able to divert the rivers of rain that course through the skies, let that diversion be for the common good and not for narrow national aggrandizement . . . If our exploration of weather modification adds one more small brick to the edifice that contains world conflict and supports world order, science will have served a noble purpose by enriching human life. And scientists bear the burden for seeing that this happens." □

A New Wave of Nuclear Power

A total of 23 nuclear generating units, with a combined capacity of nearly 19 million kilowatts, was ordered or announced during 1966 (compared with eight in 1965). It was, according to the Atomic Industrial Forum, Inc., by far the best year that the nuclear power industry has ever had.

The nuclear plant orders accounted for considerably more than half of the new generating capacity of all kinds ordered in the U.S. during the year. They will represent a capital investment of over about \$2.5 billion.

By 1980 the U.S. will probably have at least 110 million kilowatts of nuclear generating capacity, which will be at least 20 per cent of the nation's generating plant. The nuclear share of the actual output will be considerably higher, for nuclear plants in general will be operated intensively for base load generation.

Among the plants in the Atomic Industrial Forum's

"The daily conduct of our business demands new engineers and scientists, trained in the latest theory and technology. Yet in these key fields, we can already see people whose knowledge has been made obsolete within five or ten years from the time they earned graduate degrees—unless they have steadily continued their education. Here is a whole new dimension to the [educational] challenge . . . The pace of change is now so rapid that we are confronted with the prospect of education as a lifelong process—at least through a man's or woman's working life."—ROBERT C. GUINNESS, '34, President of the Standard Oil Company (Indiana), at a luncheon of the Council for Financial Aid to Education, Boston, May, 1966.



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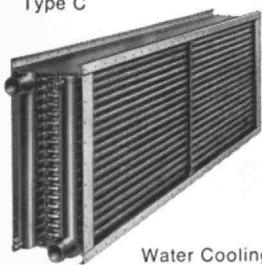
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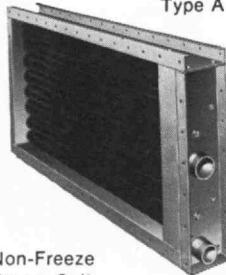
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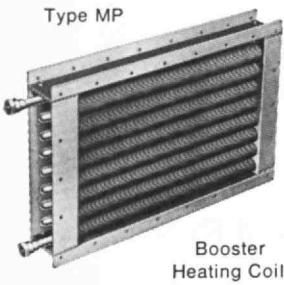
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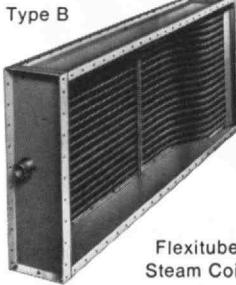
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1966 survey was the 650,000-kilowatt Pilgrim Station, a boiling water reactor generator planned for completion in 1971 in Plymouth, Mass., by the Boston Edison Company. Its \$65 million cost will place it as the second (to the Prudential Center) largest commitment of private capital ever made in Massachusetts, and it will add 30 per cent to Boston Edison's generating capacity.

Utilities choosing nuclear power in 1966 stressed that their prime motives were economic, according to the Atomic Industrial Forum. Commonwealth Edison Company with three plants on order, estimates that its large nuclear units will produce electricity at a cost about 10 per cent lower than could be achieved by coal-fired units. Tennessee Valley Authority believes its two nuclear units will have a 20 per cent generating cost advantage over coal.

Reactor manufacturers and other suppliers have now booked all the nuclear generating plant orders they can handle for completion in 1971, and some of the plants announced in 1966 are scheduled for 1972. The U.S. uranium industry, anticipating low demand and several years of depression, has made a spectacular reversal and is now exploring for new properties and planning new milling facilities; and several companies new to the uranium business, particularly major petroleum producers, have made plans to join in, according to the Atomic Industrial Forum. ■

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An Institute Gazette

Student Aid

The nation's "scarce money" situation will not affect the financial aid available to M.I.T. undergraduates for 1967-68. As in the current year, the Student Aid Center expects to award scholarships and loans to meet the full "verified" need of all undergraduates next year, and M.I.T. is "committed to continuing this policy," according to Jack H. Frailey, '44, Director of Student Aid.

Recent experience suggests that the total aid next year will be about 5 per cent higher than this year, when 54 per cent of the 3,842 undergraduates are receiving scholarships (60 per cent of the total undergraduate aid) and loans (40 per cent).

Here is how the M.I.T. awards are made: The total amount of aid is determined on the basis of the family's financial situation as reported to the College Scholarship Service. M.I.T., in turn, determines the amount of this total which can be supplied from scholarship funds, and the balance is then available as a loan through either the Technology Loan Fund or the National Defense Student Loan Fund. An average of about \$850,000 per year has been needed from the Technology Loan Fund during the last two years. Loan repayments by former borrowers amount to only \$500,000 a year, so it has been necessary to use the Fund's capital.

Undergraduates now receiving student aid from M.I.T. must reapply for next year. They are assured that the total aid package will meet their "need" as verified by the College Scholarship Service; but the proportion between scholarship and loan may be changed according to their academic and extra-curricular records for this year. In any case the percentage of scholarship aid awarded decreases for each class by an amount almost equal to the increment in summer earning power.

Architecture Head

Donlyn Lyndon, a distinguished architect, writer, and critic who has been head of the Department of Architecture at the University of Oregon, has been named to head M.I.T.'s Architectural Department.

Professor Lyndon, at the University of Oregon since 1964, was previously on the architecture faculty at the University of California (Berkeley), teaching design and architectural history. He was one of the founders of Moore, Lyndon, Turnbull and Whitaker of Berkeley, Calif., an architectural firm which has attracted national attention

with its home, apartment and condominium designs and has received numerous awards and citations. The innovative character of the firm's design for a summer resort condominium which overlooks the Pacific coastline at Sea Ranch, Calif., drew wide attention.

Lawrence B. Anderson, '30, Dean of the School of Architecture and Planning who announced the appointment, said Professor Lyndon has shown "rare versatility in the field of architecture, distinguishing himself as a designer, administrator, teacher, writer, and critic." He is West Coast correspondent for *Architectural Forum*, correspondent for *Architectural Design* (London), and contributing editor for *World Architecture 3 and 4*, and he will be the new editor of *Journal of Architectural Education*.

R.L.E. Associate Director

Samuel J. Mason, '47, Professor of Electrical Engineering and leader of the cognitive information processing group in M.I.T.'s Research Laboratory of Electronics, has been appointed an associate director of the laboratory.

Professor Mason's professional career has encompassed research and teaching in electromagnetic theory and antennas, microwave particle accelerators, electronic circuit theory, and feedback theory; and for the past several years he has conducted extensive research on sensory aids for the blind and has also worked on the associated problems of character recognition, real-time data processing, and the psychophysics of tactile and auditory displays. He has played a leading role in the development of experimental reading-machine systems.

A \$50,150 grant from the U.S. Office of Education has resulted in a major expansion of the "tutoring plus" program in Cambridge. It now recruits up to 100 tutors, most of them through the M.I.T. student Social Service Committee, to help raise the educational aspirations of Cambridge youth. A recent Cambridge visit by Martin Leshner, program management officer in the Educational Talent Section of the Office of Education (second from left, above) gave him a chance for a brief conference with Robert V. Ferrara, '67, chairman of the SSC (left); Mark H. Vaughn, a graduate student who is chairman of SSC's tutoring project; and Warren Brodey, research affiliate in the M.I.T. Research Laboratory of Electronics, who is director of the M.I.T. Science Day Camp.



D. Lyndon



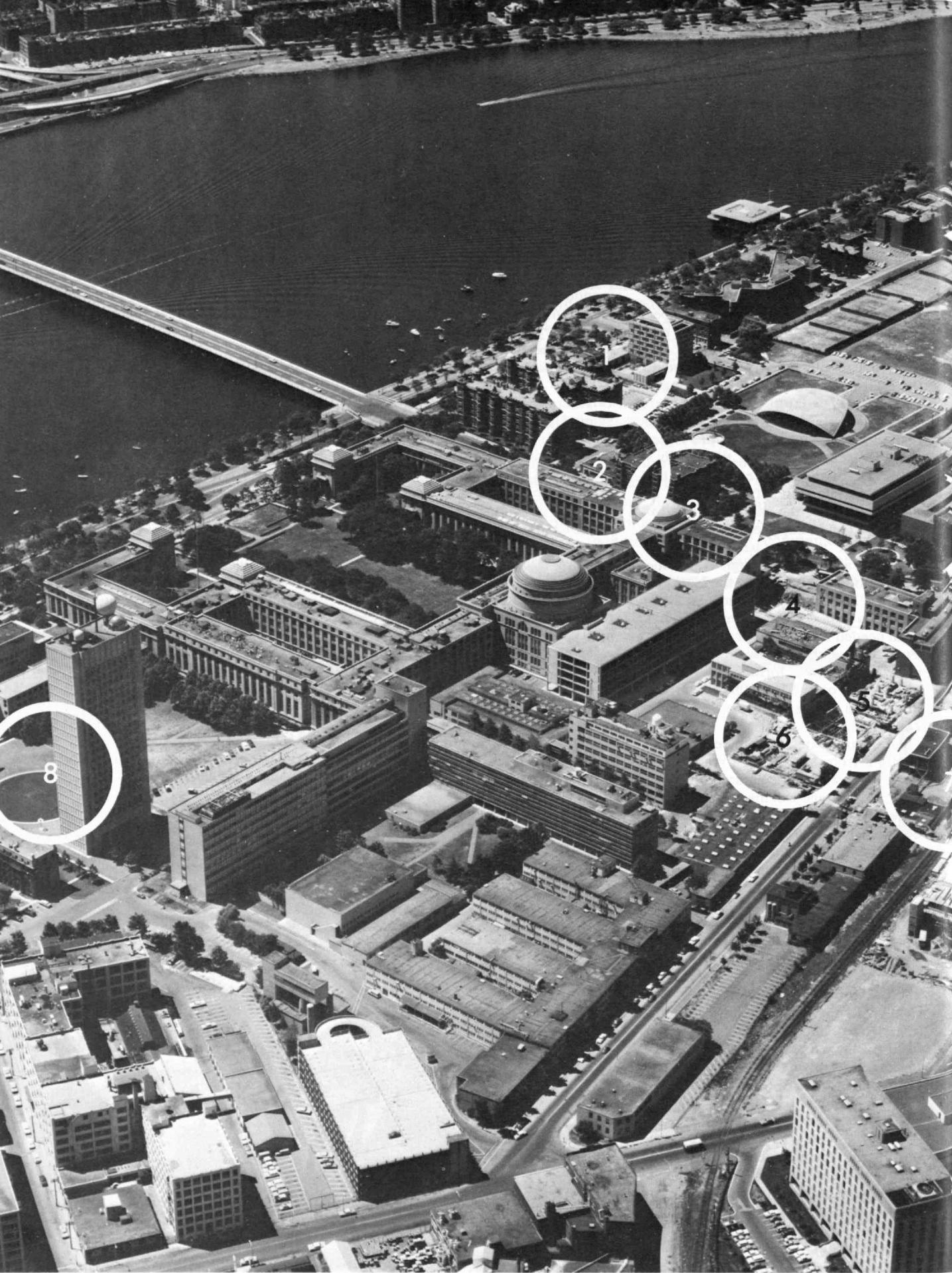
S. J. Mason, '47

"His breadth of experience and interests will be valuable supplements to the current administration of R.L.E. in connection with existing and newly-evolving programs of the laboratory," Jerome B. Wiesner, Provost, noted in announcing Professor Mason's appointment.

Professor and Mrs. Mason will be remembered by many students for their service as faculty residents in Baker House and later as House Master of Senior House.

R.L.E. is an interdepartmental laboratory in which faculty and students from a dozen academic departments conduct research in broad fields of general physics, plasma dynamics and communication sciences. In addition to direct support by M.I.T., the laboratory is supported by the Joint Services Electronics Program under a contract administered by the Army Research Office, by other Army, Navy and Air Force contracts, and by the National Institutes of Health, the National Science Foundation, the U.S. Atomic Energy Commission, the National Aeronautics and Space Administration, Bell Telephone Laboratories, Inc., and the Teagle Foundation, Inc.

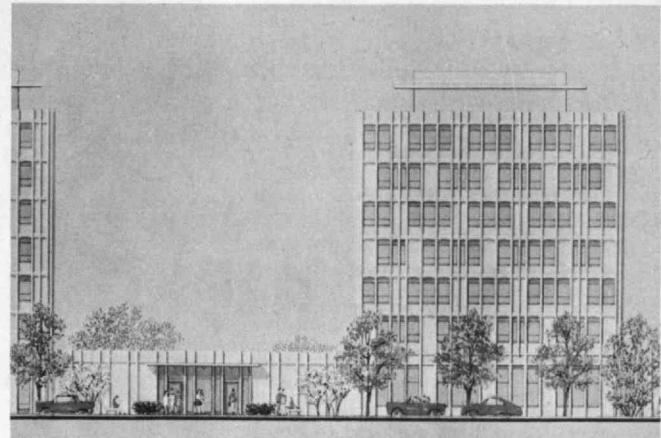






AERIAL PHOTO: LAWRENCE LOWRY

M.I.T.'s million-a-month building pace includes a second tower doubling the size of McCormick Hall (above, right, and 1 on the opposite page) and a new building for the Center for Space Research (above, left, and 5 opposite). Other central campus projects shown opposite are the visual design studios (2), pedestrian overpass (3), Center for Advanced Engineering Study (4), Computation Center (6), chilled water plant (7), and chemistry building (8).



An Institute Gazette

In the Vanguard Again

M.I.T. building construction during the first months of 1967 is maintaining the pace of nearly \$1 million per month which has been the average thus far in the decade of the 1960's.

If the present rate continues, the Institute will have spent \$100 million on construction work during the ten years ending in 1970, according to Edward T. Pieper, '49, construction manager.

Fortune magazine, commenting on M.I.T. campus planning (including some critical remarks on recent buildings) in the January issue, points out that when all the Institute's new buildings are finished, the campus plan will "hardly differ from the idea that (William Welles) Bosworth, '89, began with half a century ago." That plan, says *Fortune*, was "carefully contrived to give both grandeur and homogeneity."

The new academic buildings will serve to connect together all the academic plant, even drawing into the fold some buildings which have heretofore been under separate roofs. And, said *Fortune* magazine, "once again M.I.T. is in the architectural vanguard, for today's most radical new campuses feature continuous buildings."

Ten major projects are now under construction or in active planning:

- The building at 40 Massachusetts Avenue, formerly occupied by the Technology Store of the Harvard Cooperative Society, is being redeveloped for the visual design program of the Department of Architecture. There will be classrooms, studios, offices, darkrooms, and other special equipment—all ready by mid-summer 1967.

Marvin E. Goody ('51) and John M. Clancey ('56), Inc., are architects for the \$175,000 job.

- Eastgate, a 30-story tower, now casts its long shadow across Kendall Square; structural concrete is completed and interior detailing has begun. The building will include over 200 apartments for M.I.T. married students and faculty, a nursery school, and other community facilities, at a total project cost of \$4.5 million. The architect, Eduardo Catalano, has integrated design of the tower with his recently completed Grover M. Hermann Building, which stands adjacent. The target date is September, 1967. Construction is by Vappi and Co., Inc.

- A new building closing the gap on Massachusetts Avenue will be ready for the Center for Advanced Engineering Study by October 1. The five-story structure (with a six-floor tower extension) is estimated at \$3 million project cost; it has been designed by Walter A. Netsch, Jr., '43, of Skidmore, Owings and Merrill, Chicago, and is being built by Canter Construction Co. Plans call for one large classroom-auditorium, offices, small computer laboratory, teaching and study facilities, and special rooms for filming and taping educational materials envisioned as future C.A.E.S. projects.

- By mid-October scientists, engineers, and social scientists will also be occupying a new \$4.35 million building for the Center for Space Research on Vassar Street east of the metals processing laboratory. The largest of the educational buildings now under construction, this new laboratory will house a broad program of space-related research ranging from fundamental work on astrophysics and propulsion and guidance for interplanetary vehicles to the social and political impact

of the national space effort. Mr. Netsch is the architect, and construction is by Jackson Construction Co., Inc.

- Through the continuing generosity of Mrs. Stanley McCormick (Katharine Dexter), '04, McCormick Hall, the residence for undergraduate women, is being expanded to almost twice its present size by the addition of a second eight-story tower immediately east of the present McCormick Hall court. When the new tower is finished in February, 1968, McCormick Hall will house nearly 225 women students, and will provide as well a new music room, study rooms, and recreation area. The architect is Herbert L. Beckwith, '26, of Anderson, Beckwith and Haible, and construction is by George A. Fuller Co.

- The facade of the Center for Space Research will be continued to the east by a new Computation Center building, construction on which has just begun for completion in February, 1968. The entrance to the Institute's main campus will be incorporated into the ground floor, and the building will house the Computation Center's new IBM 360/67 computer on the third floor. Mr. Netsch is architect, and the Jackson Construction Co. is general contractor.

- Plans by Professor Catalano are nearing completion for a footbridge to cross Massachusetts Avenue between the Building 7 entrance and the Student Center, but details have not been released pending the enactment of enabling legislation by the Massachusetts General Court and additional studies by the City of Cambridge. The cost is estimated at \$500,000, and construction is tentatively scheduled to begin in the spring.

- A \$7.5 million chemistry building is

An Institute Gazette

planned for the East Campus, immediately behind the Hayden Library; the five-story building is being designed by I. M. Pei ('40) and Partners.

• Monahon Corporation of Cambridge is general contractor for a central refrigeration plant being built adjacent to the Institute power plant off Vassar Street. It will ultimately provide chilled water for cooling some of the main campus buildings; at this first stage of construction 3,000 tons of refrigeration capacity will be installed to serve four new buildings now being planned for the main campus area. Skidmore, Owings and Merrill (Chicago) is the architect-engineer.

• Over 90 acres of land are to be acquired from the Essex County Commissioners in Middleton, about 30 miles north of Cambridge, for a 400-million-electron-volt linear accelerator. Formal announcement of the plans, including financing by the Atomic Energy Commission, is expected soon; the total cost of the project will be about \$5.4 million.

"I Suck Them In, Then 'Pow!'"

M.I.T.'s undergraduate seminars are a special effort to engage freshmen with an unresolved topic in a professional field. The seminars are informal, and they usually involve individual responsibility of students and close working relationships with faculty.

This fall 300 freshmen signed up for 29 undergraduate seminars, ranging in topic from the history of Boston to programmed learning and human relations. Technology Review asked several M.I.T. faculty to tell about the results. One of them "passed the buck" to one of his students, and William C. Michels, '70, has written about Computer Systems and Information Structures: "We began the year with a wide survey of computer industry and technology today; each student prepared a talk on that particular topic. During this time we also brought up several possible projects for the latter part of the term as well as becoming familiar with the OPS system, which is a programming system created especially for Project MAC and CTSS at M.I.T.

"The group project was the attempted creation of a simulated bank run by computers. All students contributed to the creation of this supposed embezzle-proof system, while two of our number attempted to outwit the system from within. Currently the "bank" is being operated and the "crooks" have yet to report success.



A real involvement in the real world through undergraduate seminars: Robert E. Ogilvie, '52, and his freshmen used X-ray diffraction and electron microanalysis techniques to study the structure and chemistry of meteorites (above); a specimen from New York state thought to be a stony meteorite proved to be a common gabbro; and the students identified some unknown material brought back from Iran as pure gypsum (not of meteoritic origin, obviously). John F. Becker, '53, founder and president of Becker Research Corp., was one of several guests during the seminar on The Anatomy of the Senatorial Campaign conducted by John S. Saloma, 3rd, '56 (center, above). Students in Douglas P. Adams' seminar on The Birth and Care of a City toured Boston landmarks (at the right, Old North Church and Boston Harbor) and heard such men as Dr. Paul Dudley White (on the history of medicine in Boston), and Abbot Cummings (of the Society for the Preservation of New England Antiquities, on the evolution of the New England house).



PHOTOS: BOSTON GLOBE

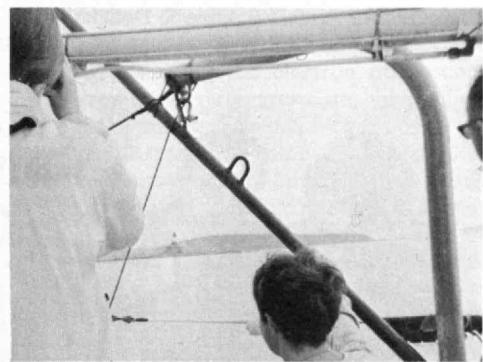


PHOTO: DOUGLAS P. ADAMS

Our individual projects were to pick a currently undeveloped use for computers and logically develop it into a practical and worthwhile system. The systems which have been developed range from law enforcement and bookmaking to the making of industrial decisions."

These are excerpts from some of the faculty reports:

"We have been setting up an experiment on stress corrosion cracking, using beaker emersion tests. The results may be quite significant, since we have found a means for answering simple questions—so simple that others have not thought to try for answers."—Herbert H. Uhlig, '32, Department of Metallurgy.

"I ask the boys what they would like to know about engines, and I try to answer their questions in some depth. We discuss the many physical phenomena which take place in engines as well as the measuring methods and instruments used in engine research. The students expressed an interest in volumetric efficiency, so they have been studying the effects of engine operating variables on this important parameter."—Augustus R. Rogowski, '28, Department of Mechanical Engineering.

" . . . a group of five freshmen has been producing new metal alloy structures by a novel technique. Alloys of gallium, aluminum, and other metals are atomized into extremely fine particles by a shock wave; then they are quenched at cooling rates as high as 100,000,000° C/sec to the temperature of liquid nitrogen. The alloys freeze with metastable and often previously unobserved crystal structures. Results are often unexpected and quite spectacular, and important contributions to knowledge and alloy theory are highly probable."—Nicholas J. Grant, '44, Department of Metallurgy.

" . . . We have been looking at a variety of information theory problems, usually special cases of what one would cover in a graduate course, but chosen to illustrate important phenomena as well as we can. The students seem to have enjoyed it, and so have I . . ."—Peter Elias, '44, Department of Electrical Engineering.

"My seminar has been dealing with optical illusions. I have displayed a variety of illusions to the class, and the students ran some experiments on their roommates and friends. We were not terribly concerned with making scientifically valid experiments; we wanted to get the feel of a research situation. One of the interesting results was our discovery that an experiment reported in the literature as being pretty close to gospel was highly inconsistent in the hands of the students. I enjoyed this, because it brought out very sharply the

fact that one need not necessarily believe all that one reads."—Murray Eden, Department of Electrical Engineering.

"The principal goal of my seminar has been to introduce the students to the philosophy and procedures involved in developing and conducting a research program. . . . We chose a problem in the field of catalysis. . . . Following lectures, laboratory training (including gas chromatography, mass spectroscopy, infrared spectrometry, and high-vacuum technique), and selective readings, the students developed an experimental program to obtain data on the specific activity of clean nickel surfaces for the hydrogenation of cyclopropane; and they performed their planned experiment as a group project and presented their results in a final report."—Charles W. Selvidge, '63, Department of Chemical Engineering.

"Our aim in this seminar has been to give the students some contact with current problems in environmental control; and to introduce them to the 'engineering approach' to problems too complex to solve in rigorous detail. We began by surveying the four general subjects fundamental to any environmental control problem. . . . Then we undertook a rather extensive project in which an apparatus was constructed to measure the thermal conductivity of flat slabs. . . . They seemed to feel that they had gained some insight into the 'engineering method,' experimental difficulties, and modelling procedures, as well as obtaining some salutary benefit from banging on nails after a tough round of quizzes."—John S. Maulbetsch, '60, Department of Mechanical Engineering.

"I have taken the freshmen to lunch at the Faculty Club in two's and three's. Last year, the girl in the course, who was extremely pleasant and pretty, invited herself twice—the first time she ate very, very sparingly, the second time she ordered the works, smiled and said to me, 'That's the way I operate. I suck them in and then Pow!' I have always had the groups out to my home where my wife and I have offered a buffet dinner. They have always, in a very disarming manner, eaten everything that wasn't nailed down, and they have written the most delightful thank-you notes and sent Christmas cards.

"Their questions tend to be extremely good, i.e., How can a company make a worker feel that he is more important than a tiny cog in a large

Nominees for Alumni Association National Officers and Corporat



Albert H. Bowker, '41, nominee for Term Member of the Corporation. Dr. Bowker, Chancellor of the City University of New York, served on the M.I.T. mathematics staff for two years following graduation and has recently been a member of the Corporation visiting committee in mathematics. Before 1963 he was at Stanford University for 12 years as Director of the Applied Mathematics and Statistics Laboratories and later Dean of the Graduate Division.



Robert C. Casselman, '39, nominee for Vice-president of the Alumni Association. Mr. Casselman is senior lecturer in the M.I.T. Sloan School of Management and Vice-president of the Cambridge Institute for Management Education. He has previously served as Vice-president of Polaroid Corp. (1956-64) and of the Boston Safe Deposit and Trust Co. (1964-66), and he has been active in Alumni Association, class, and club activities.



Robert C. Cowen, '49, nominee for the Executive Committee of the Alumni Association. The natural science editor of *The Christian Science Monitor*, Mr. Cowen is one of the nation's leading science writers. He is a member of the American Meteorological Society and the American Geophysical Union, and he is President-elect of the National Association of Science Writers. His alumini activities include the Alumni Day Committee, Long-Range Planning Committee, and M.I.T. Club of Boston.



Ralph H. Davis, nominee for President of Alumni Association. Mr. Davis has been a member of the Alumni Association Executive Committee for two years, chairman of the 1965 Alumni Day Committee, and active in regional and national activities. He is Executive Vice-president of Fairfield and Ellis, Inc., Insurance of Boston, and active in fire protection and other professional groups.

wheel? What are the basic differences between industrial and non-industrial management? How can qualified Negroes be moved into top and middle management positions? Are there other incentives to work in big industry other than those connected with position or money?"—Peter P. Gil, Sloan School of Management.

William Franks, Edward T. Trzeciak, Robert M. Hazen, and Charles B. Lawrence, registered for Professor Allan S. Douglas' ('61) fall term seminar, were among the first users of the new electron microscope in the Department of Chemical Engineering.

Alumni Nominees

The names of 30 Alumni appear on the ballot for the 1967 annual election of the M.I.T. Alumni Association.

The nominees are led by Gregory Smith, '30, selected by the Nominating Committee as candidate for President in 1967-68.

Robert C. Casselman, '39, and

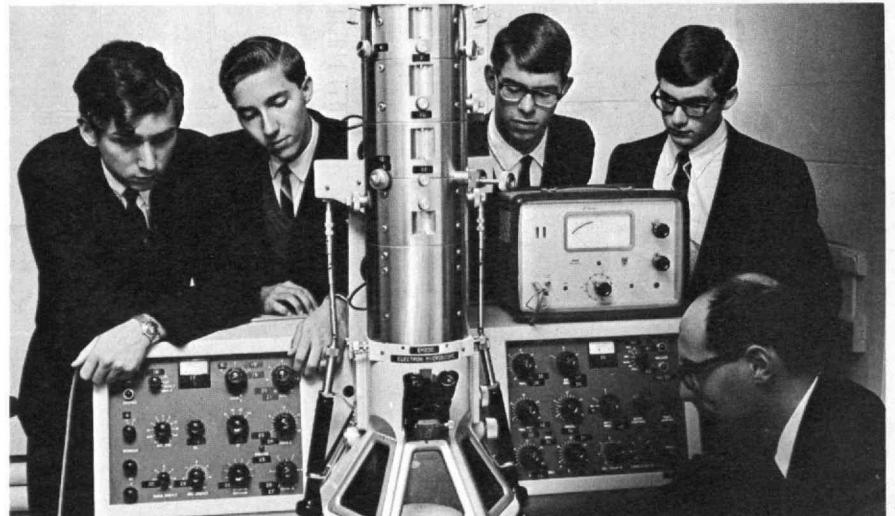


PHOTO: OWEN D. FRANKEN, '68



Ralph F. Gow, '25, nominee for Term Member of the Corporation. Associated with the Norton Co. since his graduation from M.I.T., Mr. Gow became Executive Vice-president in 1948 and President in 1961. He is a director of the Norton Co. and seven other major industrial firms, a trustee of the Worcester Memorial Hospital, and a member of the National Industrial Conference Board.

Donald A. Holden, '31, nominee for Term Member of the Corporation. Mr. Holden is President and Chairman of the Newport News Shipbuilding and Dry Dock Co. and President of the subsidiary Nuclear Service and Construction Co., Inc. He is a leader in professional affairs, President of the Society of Naval Architects and Marine Engineers, and active in support of higher education.

Herbert H. Howell, '42, nominee for the Executive Committee of the Alumni Association. Mr. Howell, who studied mechanical engineering at M.I.T., is Vice-president of Arthur D. Little, Inc. He has been a member of the Alumni Council for 15 years, chairman of the Association's Committee on Student Relations, and a member of the Alumni Day Committee; and he has served in various capacities for the Alumni Fund.

William H. MacCallum, '24, nominee for the Executive Committee of the Alumni Association. Mr. MacCallum is Chairman of the Executive Committee and Executive Vice-president of Modern Talking Picture Service, Inc., of Los Angeles and President of the National Association of Industry-Education Cooperation, a section of the National Science Teachers Association. He has been active in M.I.T. Alumni affairs for more than 30 years.

Gregory Smith, '30, nominee for President of the Alumni Association. President and General Manager of Eastman Gelatine Corp., Mr. Smith has a distinguished record of service to hospitals, schools, and other public organizations in Peabody, Mass., as well as to many M.I.T. activities. He was Vice-president of the Alumni Association in 1964-65, a member of the Executive Committee in 1963-65, and a member of the Alumni Council since 1958.

Ralph H. Davis, '31, are standing for two-year terms as Vice-presidents of the Association; and Robert C. Cowen, '49, Herbert H. Howell, '42, and William H. MacCallum '24, have been nominated for two-year terms on the Association Executive Committee.

Nominees for five-year alumni terms on the M.I.T. Corporation are Albert H. Bowker, '41, Ralph F. Gow, '25, and Donald A. Holden, '31.

Twenty-one other names appear on the ballot—nominees for class and club representatives to the Alumni Council.

Further information about the national nominees, all prominent in M.I.T. and other community activities, is given in the adjoining columns of the Review and on the annual ballot soon to be mailed to all Alumni. The polls will close on April 25.

Electron Microscopes

An electron microscope facility with two powerful electron microscopes and an adjoining instrument laboratory are now in use in the M.I.T. Department of Chemical Engineering to increase the scope and depth of research and teaching.

It will make possible expansion of fundamental studies in such areas as chemical catalysts and their physical

interactions with the materials used to support them; the structure and design of membranes for chemical separations, for example membranes under research for desalination of salt water; the chemical engineering aspects of colloids, plastic-like mixtures of finely divided particles of one substance suspended in another, and possessing electrical and surface properties of engineering importance.

One Chemical Engineering Department group under Edward W. Merrill, '47, is using the electron microscope facility in research on biomedical membranes. The field embraces both membrane technology and colloidal chemistry and is applicable to development of improved artificial kidney machines. Raymond F. Baddour, '49, and his associates, working in industrial catalysts and in membrane technology, have found the new equipment valuable in both fields.

The two electron microscopes in the facility are capable of magnification ranging from 3,000 to 219,000 diameters and 1,200 to 12,000 diameters, respectively. Also available is photo enlarging equipment; sample preparation equipment, including a microtome and a vacuum metal evaporator; precision equipment for the replication of sample surfaces on thin plastic film;

and a variety of equipment for analysis and measurements—gas and liquid chromatography, spectroscopy, light-scattering photometry, adsorption phenomena, and differential temperature analysis.

The metal evaporator is of particular value in catalyst-support interaction studies. Such industrially important catalysts as silicas can be studied in minute detail at the interface, and new catalysts and supports may be studied.

The total cost of the new facility—about \$150,000—was met by an equipment grant of the National Science Foundation (\$36,000), grants of several industrial concerns, and a special appropriation of M.I.T. funds.

Trade Your Scholar?

Campus Street, Inc., of Clifton, N.J., is offering college students a "parent swap" service, and it is for real.

The plan is simple enough: a New Jersey student (for example) who wants to try surfing in Southern California arranges to exchange homes with a Los Angelino who wants to visit the New York area.

Parental permission is necessary "but seems to be no problem," says Daniel G. Wagner, editorial director of Campus Street, Inc., sponsors of the plan.

An Institute Gazette

William H. Carlisle, 1905-1967

William H. Carlisle, who for 40 years devoted his efforts to helping students meet the expenses and other hazards of undergraduate study at M.I.T., died on January 23 after a long illness.

Three weeks before his death Mr. Carlisle had received from President Howard W. Johnson the Gordon Billard Award for outstanding service to the M.I.T. community. The citation read, "Serving with warmth and affection the abiding purposes of the Massachusetts Institute of Technology, his graciousness and goodwill have enriched generations of students."

In its obituary, the Boston *Globe* noted that "some of the nation's leading scientists and thousands of other M.I.T. graduates owe their careers" to Mr. Carlisle. "He was the kindest, most thoughtful person I've ever known," said Philip A. Stoddard, '40, Vice-president of M.I.T. "Bill Carlisle was a person whose whole life revolved around doing things for students," Jerome B. Wiesner, M.I.T. provost, told the *Globe*.

Mr. Carlisle attended M.I.T. from

1924 to 1928, then became assistant manager of the dining service, and for the last 15 years was responsible for finding and filling jobs for students who wanted to earn expenses by part-time work; he originated and for more than three decades was the adviser for the annual Assemblies Ball given by the student staff of Walker Memorial, one of the most elegant college social events in New England; and he was an enthusiastic participant in many student and campus activities.

Federal Commissions

M.I.T. alumni have central roles in two federal commissions appointed early this year to study major problems of modern technology.

Julius A. Stratton, '23, M.I.T. President-emeritus who is now chairman of the Ford Foundation, heads a 15-member commission to develop and coordinate a "long-range program in marine science for the benefit of mankind," which will include studies of fishing, weather-ocean interaction, pollution, and natural resources in and under the sea. Members of the commission appointed by President Lyndon B. Johnson include John A. Knauss, '46, Professor of Oceanography at the University of Rhode Island, and Robert M. White, '49, Administrator of the Environmental Science

Services in the U.S. Department of Commerce.

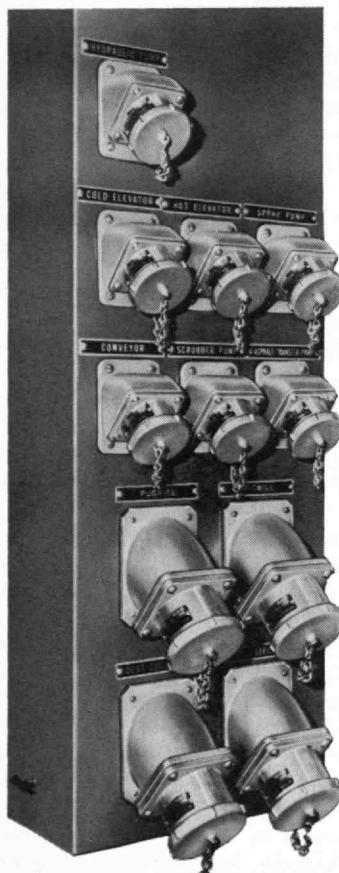
A panel on electrically powered vehicles, appointed by John T. Connor, then Secretary of Commerce, will survey the technology and economic feasibility of electric automobiles and recommend an appropriate role for the federal government in research and development. Its chairman is Richard S. Morse, '33, Senior Lecturer in the Sloan School of Management, and its members include Rolf Eliasen, '32, formerly Professor of Sanitary Engineering at M.I.T.

Off Probation

Tech Engineering News, M.I.T.'s student professional magazine with which Technology Review shares Puzzle Corner and occasionally other editorial features, has been restored to good standing (instead of probation) by Kenneth R. Wadleigh, '43, Dean of Student Affairs, acting on the recommendation of the Activities Development Board.

The "overall quality of the magazine and of the management operation has substantially improved," Dean Wadleigh said.

The credit for T.E.N.'s return to good standing goes largely to Michael Weinreich, '68, editor-in-chief, who announced in January that he would



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not continue his T.E.N. work after the end of the first term. His successor will be Alan S. Ratner, '69, associate editor.

"Considering the need for a balance between the novice and the experienced," Mr. Weinreich wrote in the January issue, "it is my feeling that it is unwise for a person to continue an association with T.E.N. after he no longer finds the work interesting."

Robert J. Van de Graaff, 1901-1967

Robert J. Van de Graaff, whom Karl T. Compton brought to M.I.T. in 1931 with a model of the Van de Graaff generator, died January 16.

He was a research associate at M.I.T. from 1931 to 1934 and a member of the physics faculty from then until 1960.

Dr. Van de Graaff's name is synonymous with the simple, large, and effective high-voltage generator which he conceived under Dr. Compton at Princeton University and built at Round Hill during the early 1930's. The original machine was later moved to the M.I.T. campus and now is installed at the Boston Museum of Science. Dr. Van de Graaff's subsequent work at M.I.T. was devoted to development of the machine and of its many applications in high-energy research, industry, and medicine. Its importance "cannot be overestimated," Victor F. Weisskopf, head of the M.I.T. Department of Physics, told Victor K. McElheny of the Boston *Globe*. "It is still the leading machine for nuclear structure."

It was in 1946 that Dr. Van de Graaff and two colleagues formed the High Voltage Engineering Corporation to exploit commercial applications of the Van de Graaff principle. During the past year Dr. Van de Graaff was working on a "very promising" experiment involving acceleration of very heavy atoms, up to and including uranium, with a large model of the electrostatic generator.

Save the Date: April 22

M.I.T.'s biennial Open House is set for Saturday, April 22. There will be exhibits, demonstrations, and other presentations of teaching, research, and student activities.

The day will have special meaning for alumni: the chairman of the student coordinating committee is Edward A. Seykota, '68, whose father is Harold R. Seykota, '39, past secretary of his class and active in many alumni affairs. Douglas P. Adams, Associate Professor of Mechanical Engineering, is chairman of the policy committee for Open House.

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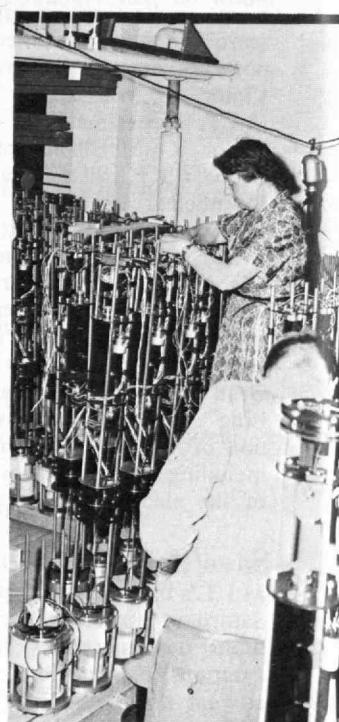
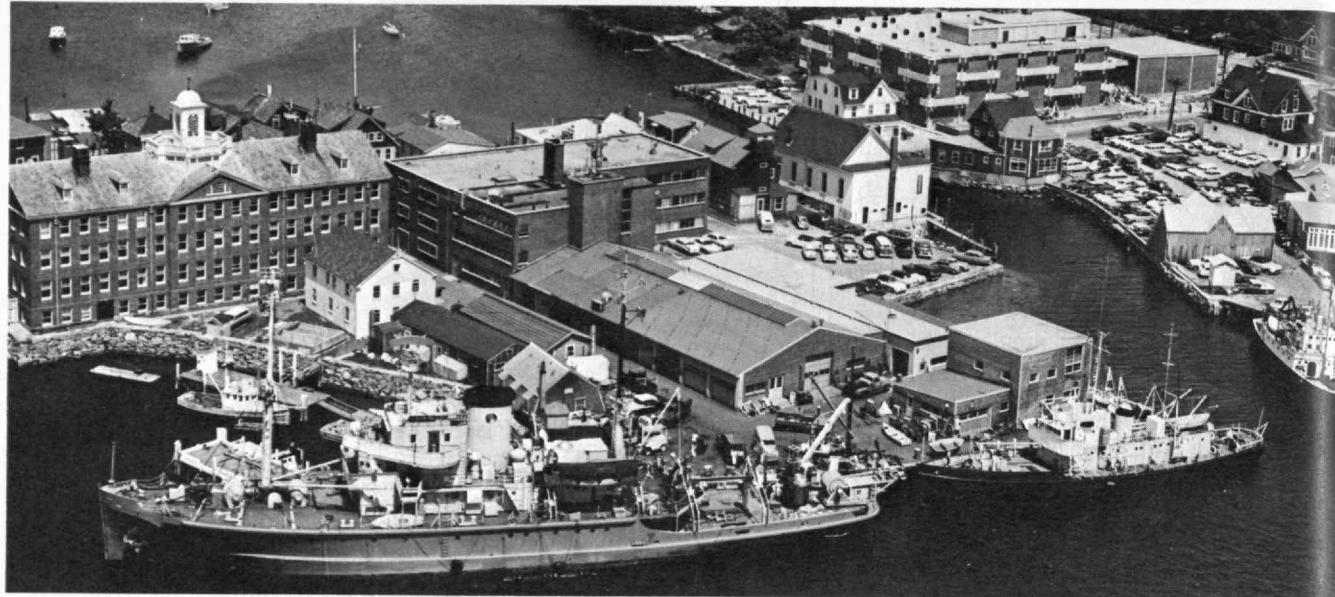
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...and the ship's hull is covered in a protective coating. The ship is now ready to be used for scientific research. The ship's name is the "Alvin".



Oceanographers Joined

M.I.T. and the Woods Hole Oceanographic Institute have agreed to jointly offer graduate degrees in oceanography, and formal commencement of the program awaits only approval by the State Board of Higher Education (for Woods Hole) and the General Court (for M.I.T.).

The doctor's degrees given under it will be the first academic degrees to bear the Woods Hole name and the first M.I.T. degrees to bear the name of any other educational institution.

Graduate students in oceanography under the new program will use the academic resources and laboratories of M.I.T. and the oceanographic research facilities and staff of Woods Hole. Their programs will be supervised by an M.I.T.-Woods Hole Education Committee, and the shared resources which they use will constitute a unique academic blend in oceanography.

Woods Hole was founded in 1930 as a non-profit organization to study all branches of oceanography. It employs about 550 personnel, including over 100 scientists in departments of physical oceanography, applied oceanography, geophysics, theoretical oceanography and meteorology, chemistry and geology, and biology. At their disposal are five ocean-going research vessels, four of which are equipped for long ocean cruises; two special aircraft; a two-man deep-diving (6,000 feet) submarine; and three large well-equipped marine laboratory buildings with docks adjacent. W.H.O.I. is the largest private employer on Cape Cod; its operating budget for 1966 was over \$8.5 million.

For its part, M.I.T. brings to the new partnership an extensive teaching and research experience in oceanography in the Departments of Geology and Geophysics and of Meteorology. About 50 graduate students are now studying for advanced degrees in oceanography (some of them expecting to receive the new joint degrees), and 10 members of the faculty devote at least part of their time to oceanography. In addition, M.I.T.'s engineering departments are seriously turning toward studies of engineering for the marine environment.

M.I.T. and Woods Hole are both charter members of the Massachusetts Association for the Marine Sciences, an 11-member consortium of universities and marine research organizations formed in April, 1966, to aid in developing facilities and educational programs.



On the deck of R. V. Atlantis, Paul M. Fye, Director of the Woods Hole Oceanographic Institution (left, above), and Howard W. Johnson, President of M.I.T., celebrate the two institutions' planned union for oceanographic education. Three of Woods Hole's four research vessels were in home port when the air view (opposite) was made—R. V. Asterias, at the left behind R. V. Chain, and R. V. Crawford at the right. Other views show D.S.R.V. Alvin, a two-man deep submergence research vehicle; laboratory assembly of deep-water current instruments in preparation for a cruise; and using a near-surface box sediment sampler at sea.

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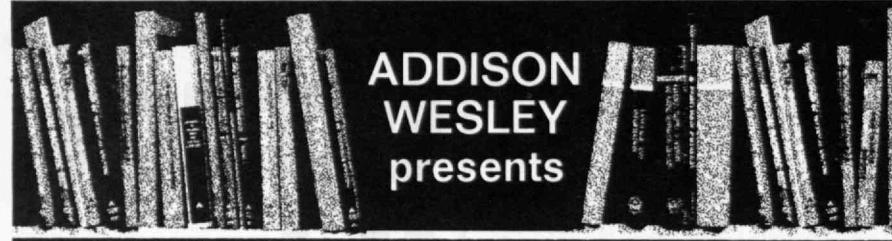
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By PETER H. O'N. ROE, *University of Waterloo* 336 pp, 185 illus (1966) \$12.50

The primary purpose of this text is to provide insight into a unified discipline of physical system theory, without resorting to analogies. The concise and exact method developed encompasses RLCM network theory, and is easily extended to deal with other kinds of systems.

NONLINEAR NETWORKS AND SYSTEMS (7275)

By THOMAS E. STERN, *Columbia University* 594 pp, 309 illus (1965) \$18.50

Essentially concerned with the mathematical aspects of nonlinear systems, this book limits itself generally to those topics which are very well understood mathematically. The volume is intended to be of interest to research engineers and graduate students of electrical engineering. Of particular interest is the material on stability and Lagrangian formulation.

HANDBOOK OF ELECTRON TUBE AND VACUUM TECHNIQUES (6500)

By FRED ROSEBURY, *Massachusetts Institute of Technology* 587 pp, 154 illus (1965) \$17.50

An extension of the author's well known MIT *Tube Laboratory Manual*, this book covers the practical and working data needed by technicians, students, and engineers. It contains a minimum of theoretical and mathematical material. Designed to stand in place of several unwieldy reference books, the volume includes a comprehensive glossary of terms and material data.

TRANSISTOR CIRCUIT ANALYSIS (3400)

By THE LATE MAURICE V. JOYCE AND KENNETH K. CLARKE, *Polytechnic Institute of Brooklyn* 461 pp, 362 illus (1961) \$11.75

This book presents the basic methods of analysis involved in the understanding and design of junction transistor circuitry. It employs only those transistor models which are easily interrelated. Written at the senior-graduate level, the book may be used as a text or as a reference volume for circuit designers.

LINEAR DATA SMOOTHING AND PREDICTION IN THEORY AND PRACTICE (0610)

By R. B. BLACKMAN, *Bell Telephone Laboratories, Inc.* 182 pp, 79 illus (1965) \$12.50

This treatment in depth of finite-memory polynomial filters and predictors is written at the senior-graduate level. It describes how practice can advantageously depart from theory, and places special emphasis on quantitative effects. Of special interest to those working in automatic control, the book will also be valuable to engineers in the fields of missile guidance, radar tracking, and data processing.

MATRIX ALGEBRA FOR ELECTRICAL ENGINEERS (0651)

By R. BRAAE, *Rhodes University* 162 pp, 22 illus (1964) \$4.95

A self-study text designed to enable the electrical engineer to read material employing matrix techniques, this book assumes no more than a standard engineering mathematics background. The text progresses from first principles to advanced topics and applications, and develops the theory of matrices in such a way as to dovetail with that of tensors.

LINEAR ANALYSIS OF ELECTRONIC CIRCUITS (2405)

By GLENN M. GLASFORD, *Syracuse University* 580 pp, 272 illus (1965) \$15.00

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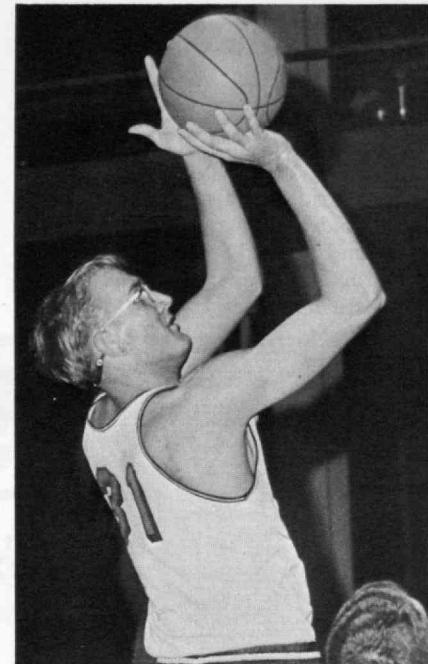


PHOTO: JEFFREY M. REYNOLDS, '69

Alexander D. Wilson, '67, is the new M.I.T. all-time high basketball scorer. He reached his record (1066 points) on Tuesday night, January 17, when he scored 18 points against the University of New Hampshire to pace M.I.T. to a 96-64 win—their sixth straight and 11th out of 14 this season. Last year Alex set Tech single-season marks in total points (559), field goals (214), and free throws (131). He came to M.I.T. in 1963 from Corning, New York, where he played center. But his choice wasn't a matter of basketball. "My father put it to me this way," Alex told the Boston *Globe* after his record-setting evening. "Where would you rather graduate from?" I chose M.I.T." Alex's father is Richmond W. Wilson, 40, who earned letters in basketball and track. And his grandfather, Louis A. Wilson, '14, was a trackman.

An Institute Gazette

A Growing Fund

The 1967 Alumni Fund enters the intensive "regional solicitation" program on March 1 with 200 regions now organized and an estimated 30 more to be added before the campaign closes. As of February 17, 9,870 Alumni had given \$1,239,030. In addition, the Fund has received nearly 800 pledges representing over \$150,000 payable before the end of the year.

In addition to the regional solicitation, several classes are undertaking intensive reunion gift drives. Their efforts, plus those of Class Agents in non-reunion classes, are expected to bring the Fund close to its goal by Alumni Day on June 12, according to Kenneth S. Brock, '48, Director of the Fund.

The plan for pledging to the Fund is new this year. Under the system, a donor can indicate that he will give before June 30 (the end of the Fund year), specifying the amount if he wishes; he is considered a current contributor, receives *Technology Review*, and is reminded of his pledge shortly before its due date.

Mathematics Prizes

Three M.I.T. students were among the five highest-ranking entrants in this year's William Lowell Putnam national competition. And the Institute's team placed second in the intercollegiate team competition.

M.I.T.'s winners were Theodore C. Chang, '67, Richard C. Schroeppel, '68, and Robert S. Winternitz, '68. Each won a \$75 prize. Gerald S. Gras, '69, won \$35 by placing among the next 10 ranking entrants.

Mr. Chang, Mr. Gras, and Michael R. Rolle, '67, were members of M.I.T.'s second-place team; the team prize of \$400 goes to M.I.T., and each team member won \$40.

Harvard won this year's top award for the ninth time; it was M.I.T.'s sixth time with a second-place team.

The Putnam competition is conducted under the auspices of the Mathematical Association of America; this year 259 institutions registered students in the competition and a total of 1,526 wrote the competitive examination for which the prizes are given.

The examination consists of 12 original problems, and each student must devise his own methods for each solution. "The top contestants," says the M.A.A., "display a considerable amount of creativity in their solutions."

“We Know Him Well”

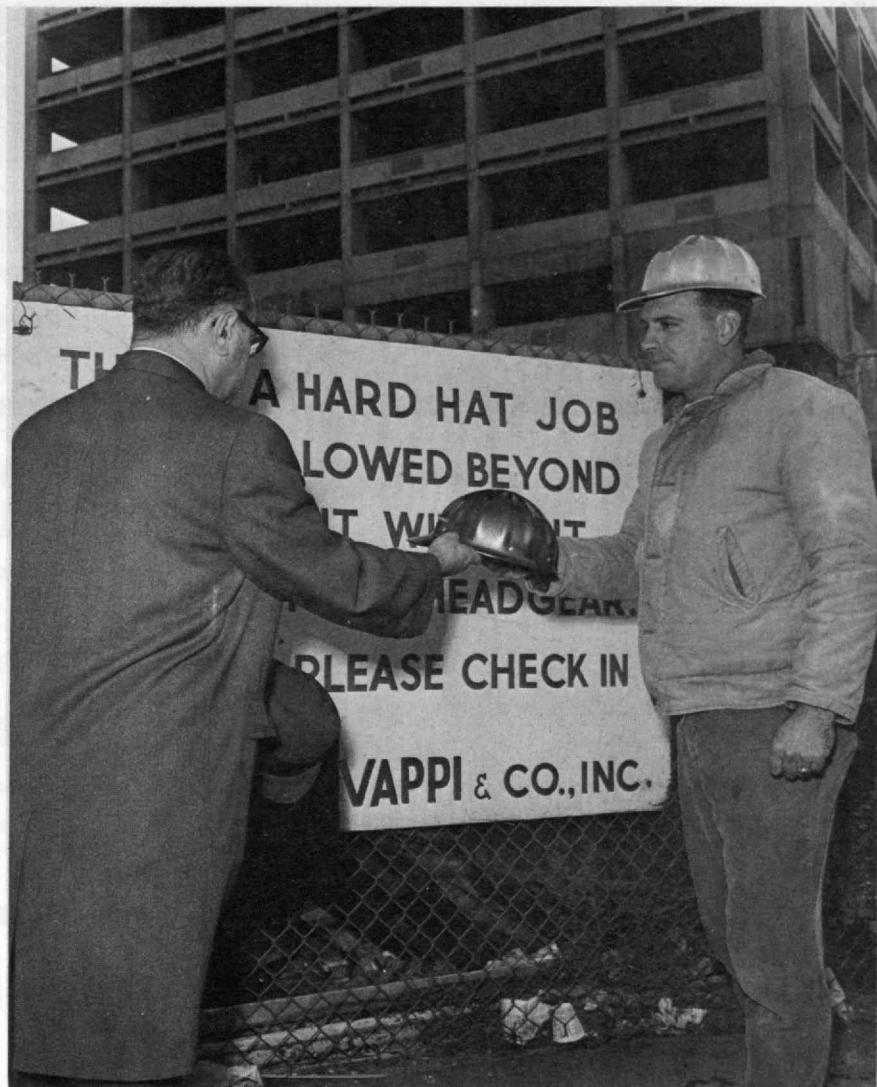
For 23 years, foreign students at M.I.T. benefited from the gentle wisdom and keen humor of Paul M. Chalmers, foreign student adviser. Now the parents of M.I.T. undergraduates are the chief beneficiaries.

Professor Chalmers retired from the Foreign Student Office last spring. Now he is writing a four-page monthly newsletter for parents, the *M.I.T. Observer*, and his observations are both wise and witty. For example (from January):

"Headline from *The Tech* on article about Junior Prom: JP Blast 'Successful.' I would have written: JP 'Blast' Successful. Just goes to show."

"After being trapped several times going down in the up elevator, I have coined a new aphorism: 'Man proposes, Otis disposes.'"

For 15 years the Sunday Pogo strip appeared on the bulletin board outside Professor Chalmers' office every Mon-



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H. A. Kuljian '19 E. J. Healy '24 A. H. Kuljian '48
1200 NO. BROAD ST., PHILADELPHIA, PA. 19121

day morning. In December came a few words in the *Observer* about Pogo's new locale (pre-history instead of Okefenokee) and friends (various "horrendous, and un-funny, dinosaur-types") under the heading "Alas poor Pogo! I knew him, Horatio." In January a further explanation from the one-time professor of English. "About that quotation from *Hamlet*: it is correct (except, of course, Pogo for Yorick). It is usually mis-quoted, a sort of 'folk misquotation,' popular use improving on the author. Ask your friends to complete: 'Alas poor Yorick . . . and most will say, 'I knew him well.'"

Musical Drama

Double honors came to composer Elliott Carter at the end of his first-term assignment as visiting professor at M.I.T.

"The most original and powerful work by an American composer," was the description by Boston *Globe* reviewer Michael Steinberg of Professor Carter's piano concerto, given its premiere performance by the Boston Symphony Orchestra early in January. The concerto "establishes the most dramatic confrontation of solo and orchestra since Beethoven," Mr. Steinberg wrote.

A week later Professor Carter was honored at M.I.T. when the William Abramowitz Memorial Lecture was devoted to a recital of his works by the Lenox Quartet and members of the Dorian Wind Quintet. The program included the second string quartet, a fantasy for woodwinds, and a sonata for harpsichord, flute, oboe, and cello; Mr. Steinberg, obviously a Carter fan, said the performance "realized with exceptional vividness the excitement of Carter's musical drama."

The Abramowitz lecture series was established at M.I.T. in 1961 by William Abramowitz, Jr., '35, in memory of his father.

Reading Period Extended

To obtain data on "the usefulness of the reading period for integrating the work of the term and preparing for final examinations," the Committee on Academic Performance has recommended, and the faculty has agreed, to an extension of the spring term "reading period" preceding final examinations. In 1967 five days—a full week, from May 22 through 26—will be set aside for this purpose, instead of the traditional three days. Classes will not meet, but term papers may be assigned for completion on May 22 or 23.

Hungry Horde

Students eating "commons" meals in the M.I.T. dormitories this spring can have "unlimited seconds," if they're willing to go through the line a second (or third?) time. Late this spring they will vote: a continuation of "unlimited seconds" next fall and an increase in price, or a return to the "one-time only" system at present costs.

Compton Non-Lecture

Plans were largely completed by mid-January for a Karl Taylor Compton Lecture to be delivered at M.I.T. on February 3 by Eduardo Frei Montalva, President of the Republic of Chile.

But neither M.I.T. nor President Frei had consulted the Chilean Sen-

ate, whose approval is required for the President to leave the country. And the President's opposition, including both right- and left-wing elements, found the perfect humiliation by refusing to approve the trip. (The requirement for approval stems from sailing-ship days, when out-of-the-country trips meant prolonged absence and considerable personal risk.) It was the first "no" vote on the question in Chilean parliamentary history.

President Frei was to have visited Washington for two days before his M.I.T. appearance, and Everett M. Dirksen, Senate Minority Leader, commented that "it is strange when a legislative branch vetoes the visit by the official wielder of the tin cup who

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is expected to bring back largesse." President Frei's Compton lecture at M.I.T. on "The Changing Balance Between Economic Development and Social Progress" has been "indefinitely" postponed.

While unprecedented at M.I.T., "non-lectures" are a tradition at nearby Brown University in Providence. On Friday, January 13, the Brown Weekly Bulletin announced a "not lecture" by Josiah S. Carberry, Chairman of the Department of Ceramics, on "Psycho-Ceramic Phenomena in Connection with the Neo-Protestant Movement at Berkeley." Instead of a lecture, "Professor" Carberry's appearance was said to signal a private celebration by the Brown faculty.

Young and Inexperienced

Twenty-nine players and one computer entered in an official rated U.S. Chess Federation tournament one day this winter at the Boston Young Men's Christian Union, and the combination attracted a bit of newspaper notoriety.

The computer lost to Carl E. Wagner, '61, a chess master, in 55 moves in the first round of competition. "He's not too good, but he'd beat a beginner," said Mr. Wagner to Boston *Globe* reporter Jonathan Klarfeld.

The computer, which was issued an honorary membership in the federation in the name of Robert Q. Computer so that it could technically qualify to play, was really on the M.I.T. campus, connected by telephone circuits to the Y.M.C.U. It was a small machine programmed to play chess by Richard D. Greenblatt of the M.I.T. Computation Center as an experiment in artificial intelligence. A computer can play a good game of checkers, but chess is harder; there are too many possible moves for the computer to digest them all, the *Globe* was told.

And, said the tournament director, "It's a young, inexperienced, comparatively stupid computer."

B.U., Tufts Presidents

Two of M.I.T.'s academic neighbors selected new presidents as 1967 began.

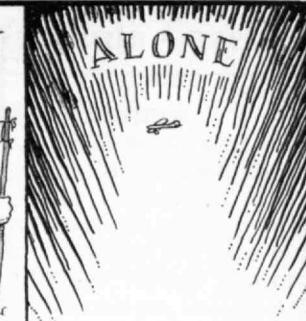
Arland F. Christ-Janer, who now heads Cornell College (Mt. Vernon, Iowa), will be president of Boston University beginning on July 1. Dr. Christ-Janer is a native of Nebraska and had a midwestern liberal arts education at Carleton College.

In September, Burton C. Hallowell, executive vice-president of Wesleyan University, will be president of Tufts. A Wesleyan alumnus, Dr. Hallowell has been on the faculty since 1941.

ALUMNI as noted

THE CLASS NOTES SECTION OF THE REVIEW records the latest doings of your fellow alumni ~ Some warrant a wider audience than the classmates for whom they are written ~ Here, then, are a few items of broad interest, as noted by the Class Secretaries ~ ~ ~

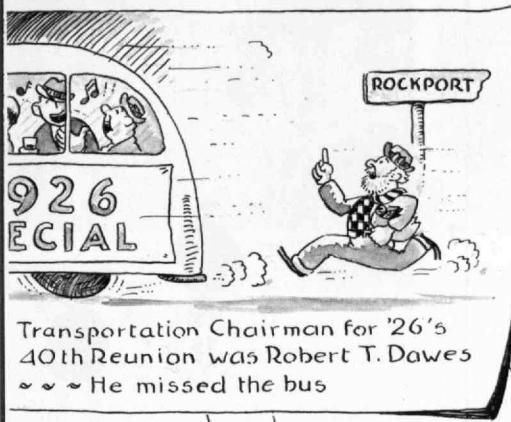
To celebrate his 82nd birthday, Milton MacGregor '07 climbed Mt. Washington



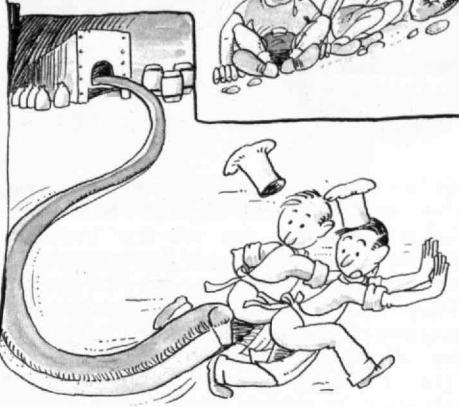
ALONE

Marion Rice Hart '13, flew the Atlantic solo ~ ~ ~ again!

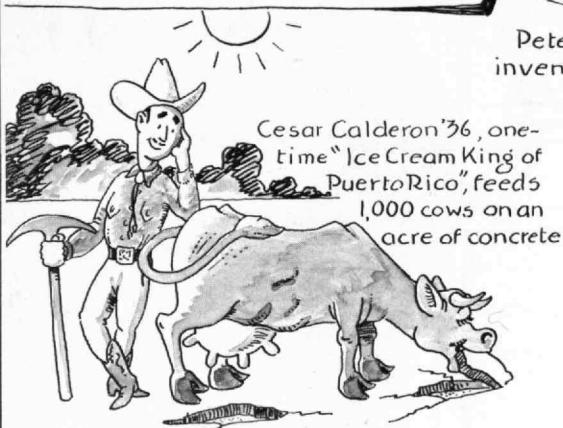
and now... a 60-second commercial break...



Transportation Chairman for '26's 40th Reunion was Robert T. Dawes ~ ~ ~ He missed the bus



Pete ('51) and Chris ('56) Booras have invented a continuous loaf of bread



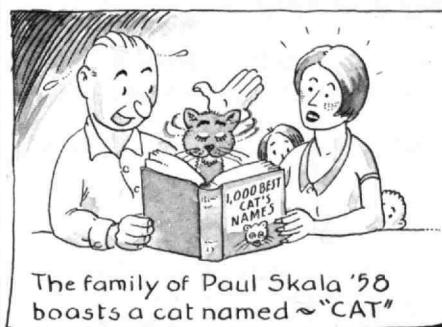
Cesar Calderon '36, one-time "Ice Cream King of Puerto Rico", feeds 1,000 cows on an acre of concrete



Barry Brown '56 has received 3 awards for his outstanding use of photography in TV commercials



For years the golden lining of VooDoo, William B. Elmer '22 designed lighting for the Miss America pageant



The family of Paul Skala '58 boasts a cat named ~ "CAT"



According to FORTUNE, Paul Heckel '63 has a system for calling any U.S. phone and some European ~ ~ Free!



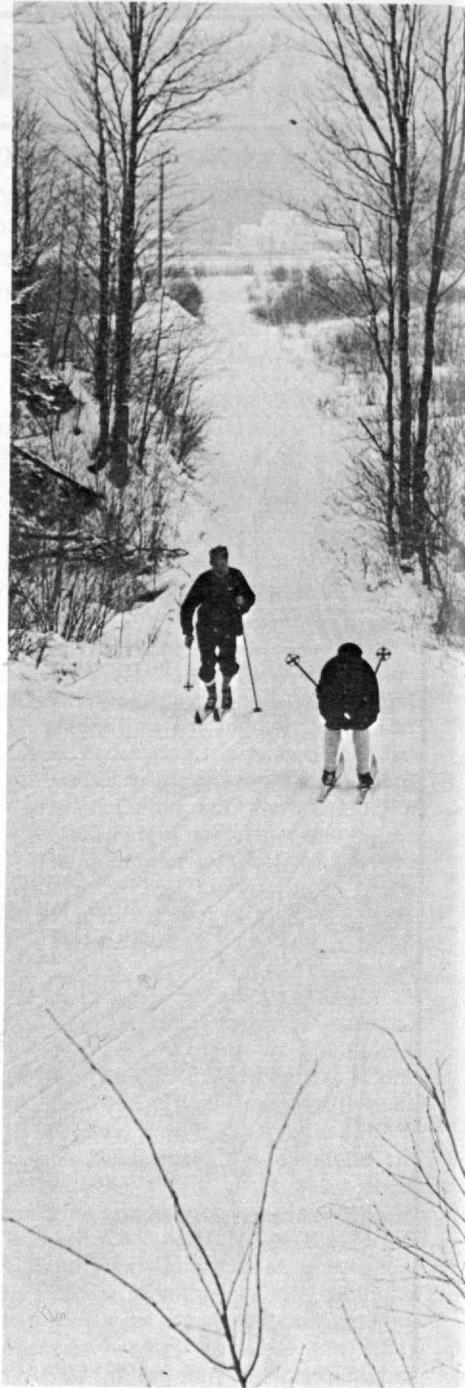
Another collector, Paul Wing '34, has more than 1,200 old stereo photos

Finding himself marooned by stormy weather at Chatham Bars Inn where the Class of 1951 was reuniting, Probate Judge K.A. Sparrow joined in the revels, left after two days as an Honorary Member





If the value of an engineer is computed in terms of his contribution to technology, then the men who brought to reality such systems as Polaris and Agena are worthy indeed. They, and others like them at Lockheed, who designed and built these pacesetters of modern technology do not doubt their own importance. Their contribution is unquestioned. And their significance far transcends the glamour surrounding these achievements. Here are men of dedication. Acceptors not merely of the challenges of their own intrinsic curiosity, but of the generation in which they live as well. You too, will have the opportunity to participate in history at Lockheed. Write: Mr. R. C. Birdsall, Professional Placement Manager. P.O. Box 504, **LOCKHEED** MISSILES & SPACE COMPANY A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION



PHOTOS: OWEN G. FRANKEN, '68

The M.I.T. ski team spent the "inter-session" week (between first and second terms) at Franconia, New Hampshire, and on the slopes of Cannon Mountain. Technology Review's photographer arrived on the scene during a blizzard, found the skiers, undaunted, training on cross-country and slalom courses and thereafter successfully ministering to the inner man.

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The affinity group flights are limited to the members of the M.I.T. Alumni Association and their immediate families; arrangements will be made by Tech Travel Service, an official student agency of the Technology Student Enterprises Corporation on campus.

A Female Presence

A minor contention has enmeshed the women residents of Ashdown House, graduate students' dormitory.

To help control the sizable waiting list, Emily L. Wick, '51, Associate Dean of Student Affairs, proposed last spring that women live in Ashdown House only for four terms and that admission from the waiting list be arranged so that Ashdown House would contain a balance of "new" and "old" women students. These limitations, which have no parallel for the male residents, are far from popular among the distaff side.

Girls have now been living in Ashdown House for 18 months. Their arrival and experiences there were described by Miss Hannah Friedman in the fall issue of *The Catalyst*, the newsletter of the Graduate Student Council:

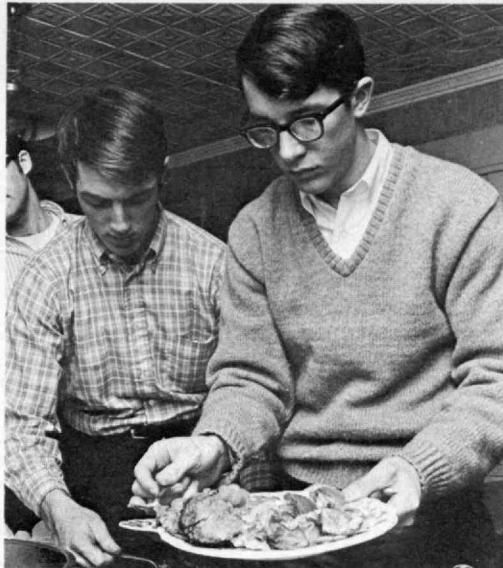
"A huge graduate student complex for M.I.T. is in the planning stage, and one of its happy aims is the housing of graduate women. Of course, such a radical move is not made at M.I.T. without a preliminary experiment. Thus, with the blessings of the administration and with hurrahs from the boys, Dean Frederick G. Fassett, Jr., was able to capture 27 beds for women in the House master's wing of Ashdown House in the fall of 1965.

"The immediate result was nothing, really. Ashdown House holds 430 people, and the 26 girls who entered were hardly noticed. True, they added a bit of graceful decor to House teas and "buttery" hours. However, no stifling of TV-room wisecracks was observed. Many girls were startled to meet men nonchalantly wearing only towels en route to the showers in the basement.

"Feeling somewhat ignored, the girls threw a punch party for the House. Ten valiant girls entertained about 200 men that night, but everyone left feeling that there weren't enough women in the House.

"Men graduate students have voiced uniform opposition to the new policy on two counts. First, Ashdown House is a cohesive autonomous unit; it is not clear why one segment of the House should be under a different jurisdiction and follow a separate system from the rest. Secondly, and more profoundly, they disagreed with the philosophy.

"Why should the proportion of various classes of residents mimic their proportions in M.I.T.? The percentage of women among graduate students is 3.1. This percentage is clearly too low if there is to be a female presence in Ashdown House."





Wilma Marsh was a "nurse" when she was seven.

Now she's a nurse...for real...at General Motors.



There was a big difference between playing nurse and Wilma Marsh's first day as a nurse's aide at St. Joseph's Hospital in Flint, Michigan. When ordered to give a patient a bath, she fainted. Coming out of it, Wilma heard the doctor's remark, "This kid is never going to make it as a nurse."

That's when she made up her mind. *"Wilma will make it!"*

That was some 12 years ago, and Wilma has been in nursing ever since. Upon graduation from St. Joseph's she worked there for about 10 years. Now she's a full-time nurse at one of the Buick plant's 12 medical stations.

Her work is providing on-the-spot nursing service to employees with medical problems. Like all GM nurses, Wilma works under a doctor's guidance. She is well trained, capable, experienced and dedicated to her profession.

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'94

Dr. Charles G. Abbot, 'retired' for 22 years, is still at work—although his major work has never been accepted by most of his peers and he suspects that it may soon become invalidated by the world's turmoil. Dr. Abbot is a former director of the Smithsonian Institution's Astrophysical Laboratory, and former head of the Smithsonian itself. Although in his 72 professional years he has invented, designed and redesigned many astronomical instruments, his major work has been with pen and paper: erecting a scaffolding of statistics on which to build a system of long-term weather forecasting based on solar cycles. Just one of his multitudinous scrolls, when unwrapped from around a Mother's Oats box, stretches 20 feet across his living room floor—and bears at least 28,000 handwritten entries. It holds the weather history of St. Louis for 104 years, 1854-1957. Along the chart zig-zags a red line and a blue line, one marking what the weather should have been under Dr. Abbot's theories and one marking what it actually was. In many places the two lines march closely together, up and down. In other spots the lines appear never to have been introduced. They ignore each other. Dr. Abbot points to these periods as times the atmosphere was suddenly excessively polluted—the eruption of Krakatoa in 1883 that spread dust around the world, the periods of heavy atomic bomb testing. That's why he fears that his system, based on meteorological records, might become useless. 'The present proposals to improve weather may alter atmospheric circulation so much that world weather records of the past may become useless for forecasts. There is also the danger that France, China, India, Indonesia and other countries may explode bombs. Thus my method of prediction for generations to come may go into the discard.' He claims from 50 to 70 percent accuracy for his predictions.

Raised in Wilton, N. H., Dr. Abbot was interested in mechanical things. He entered science, according to him, by happenstance. 'Some friends were going to M.I.T. to take entrance exams. I thought it was a good time to see the place, so I went along. But then I was afraid I'd get lost, so I went in and took the exam too.' He was graduated in 1894, took a master's degree in 1895, and joined the Smithsonian."—*Science News*, 10 December 1966, Volume 90

'96

In Waltham, Mass., **Robert A. Davis** died suddenly on January 6, 1967. He was employed in the Commercial Engineering Department of the New England Tele-

Happy Birthday

Out of 23 Honor Roll birthdays this month two alumni will celebrate their 90th, eight their 85th and thirteen their 80th.

March, 1877—**BATISTA P. SANCHEZ**, '99, on the 9th; **WILLIAM C. TWIEG**, '03, on the 14th.

March, 1882—**HERMAN EISELE**, '05, on the 2nd; **FRED H. ABBOTT**, '05, and **PATRICK J. SULLIVAN**, '05, on the 10th; **FRANK A. H. KELLY**, '06, on the 12th; **HERBERT K. DRAPER**, '04, on the 16th; **SPENCER A. CUTTING**, '06, and **JOHN V.**

VREDENBURGH, '04, on the 17th; **GEORGE H. GARCELON**, '03, on the 26th.

March, 1887—**ALFRED HAGUE**, '10, on the 4th; **PHILLIP T. HARRIS**, '10, and **EDWARD F. MERRILL**, '10, on the 7th; **LESTER H. KING**, '09, and **HAROLD A. SMITH**, '10, on the 11th; **HAROLD C. FAXON**, '08, on the 13th; **PIERRE DREWSEN**, '12, on the 17th; **CHARLES S. COTTER**, '08, and **ENRIQUE J. MUÑOZ**, '10, on the 19th; **JOHN C. FREEMAN**, '12, and **ARTHUR T. HINCKLEY**, '08, on the 21st; **GLADYS M. E. HARDY**, '09, on the 24th; **GEORGE W. SHELDON**, '10, on the 29th.

phone Company from 1897 until his retirement in 1938, at which time he was in charge of all commercial engineering for the Company in the New England States. He was able to drive his auto from Waltham to Wellesley last February to attend **Myron Pierce**'s funeral; his tennis and golf at Cummaquid links must have qualified him for the recent issue of a drivers license. Funeral service was conducted by the Reverend Byrd W. Helligas, Minister of First Parish Unitarian Church, at the Davis home, 18 Harris Street, Waltham, to which the class sent flowers, also a note of sympathy to his wife, Mrs. Adele (Smith) Davis, son William Davis of Hollis, N.H., and daughter (Raymah) Mrs. Goram Harper of Yarmouthport, Mass. The burial was in Woodside Cemetery in Yarmouthport where the Reverend Kenneth R. Warren of the First Parish, Barnstable, offered the committal prayers.—**James M. Driscoll**, Secretary, 129 Walnut St., Brookline, Mass. 02146

'97

Next June we will have had our B.S. degrees for 70 years. Shall we have a reunion? At our 60th Reunion luncheon at Dedham we had 13 members. To the best of my knowledge four of these are now living. **Will Binley** seems to be the only member getting to June occasions. What about it?—**George R. Wadleigh**, Acting Secretary, 70 Flower Avenue, Hastings-On-Hudson, N.Y.

'99

As this was written on January 15th, the Christmas and birthday cards sent to all members by the Secretary have been acknowledged by **Miss Eugenia B. Frothingham**, a gracious lady of 93; **Norman E. Seavey**, **Frederick W. Grover**, **Philip Burgess**, **Hervey J. Skinner**, **George P. Dike**, all 90; **James G. Leiper, Jr.**, **Lewis W. Riddle**, **George O. Steinwedell**, all 89; **Carroll W. Brown**, 87. When you see this Review new birthdays will have passed, **William H. Kimball**, February 22; **David C. Churchill**, March 17. . . . **Percy W. Witherell** accepted an invitation to dinner from his son Dana for January 8th. On arriving at his son's home he was greeted

by "Happy 90th birthday, Grandpa," by his four children, ten grandchildren plus wives and husbands and three great-grandchildren. In a story in the **Woonsocket Call** it was noted that Witherell was starting his 64th year as a Notary Public and was active in astronomy, Masonry, civil defense and auditing. He was comptroller of the Algonquin Club of Boston until his retirement at the age of 75.—**Percy W. Witherell**, Secretary, 1162 West St., Wrentham, Mass. 02093

'02

In a recent letter **Bill Kellogg** noted that in June our class celebrates the 65th anniversary of its graduation, and he hopes we will have a gathering of our members. How do you feel about it? Possibly a separate table at the Alumni Day luncheon or at the banquet or both? Or should we be more ambitious? Kellogg's letter also enclosed an engraved announcement which he had received announcing that Mrs. Wilma Henderson Leslie and Mr. **James Loockerman Taylor, Jr.**, were married on December 15, 1966, in the Shadyside Presbyterian Church, Pittsburgh, Pa. Their home address is Chatham Center Apartment Tower, Pittsburgh. . . . **Kenneth C. Grant**'s son has written the Review that his father passed away on December 12, 1966. The son enclosed a résumé of his father's professional career, and it is given below. "Born on October 15, 1880, in Newport, R.I., and raised at Bayview Ave., Kenneth C. Grant was graduated from the Coddington Grammar School in 1894 where he received the Gibbs Medal for scholarship. He then attended Rogers High School where he took the George E. Norman award in his senior year for English composition. Determined to study engineering he was befriended by Mrs. Wm. Barton Rogers, wife of M.I.T.'s first president. In 1898 he was awarded the Wm. Barton Rogers scholarship of \$250. Earning additional income as both organist and choirmaster at Trinity Church in Newport, he graduated from M.I.T. in 1902 with a degree in civil engineering. While there he was a member of the track and relay teams as well as the Athletic Association. After graduation he spent an additional year as an instructor at the Institute in the Civil Engineering Department and then spent three years as assistant engineer

with the U.S. Navy Department on construction of a large coaling station on Narragansett Bay. Thereafter he went to the territory of Hawaii for two years as principal and later chief engineer on railroad location and construction projects for the Koolau Railway Company on the island of Oahu. Returning to the mainland in 1907, he was then appointed principal assistant engineer to the Pennsylvania State Water Supply Commission, being concerned primarily with stream flow and rainfall studies as they related to flood prevention. Thereafter in 1912 he was commissioned by the City of Pittsburgh Flood Commission and made an in-depth study of river improvements and flood prevention methods. His report was over 800 pages in length and represented the most exhaustive study of a flood protection problem ever made in the United States up to that time. On March 26, 1913, he married Janette Garner formerly of Pittsburgh in St. John's Episcopal Church in Los Angeles, Calif. He worked with the Miami Conservatory District in Ohio on flood protection plans for the Miami Valley until he was commissioned a captain in the engineer section of the U.S. Army, April 1917. After war-time services he moved to Los Angeles where in 1922 he established the structural engineering firm of Grant & Bruner, Ltd. Thereafter and until the firm was dissolved in 1954, he designed and built a number of the pioneer commercial and industrial structures in the greater Los Angeles area including Helms Bakeries, Weber Showcase and Fixture Company, U.S. Motors and the Don Baxter Laboratories. He was a life member of the American Society of Civil Engineers. He leaves his wife Janette, a son, John, a daughter, Mrs. E. P. Garnier and three grandchildren, all of Los Angeles." Change of address, **Howard Baetjer** is now at Valley Road and Park Heights Ave., Stevenson, Md. 21153.—**Burton G. Philbrick**, Secretary, 18 Ocean Ave., Salem, Mass. 01970

'03

Well, classmates, the M.I.T. class secretaries are obliged to write their March reports in January, or two months in advance, so New Year resolutions, though now uppermost in our minds, will seem quite trite when read. Again though, occasional pleading for some news from our now restfully retired members should afford ample time for more life sketches with their pictures. The Review staff has generously responded to print our class pictures at last, to adorn our former unvarying monotonous appeal to the reader of our notes. Accordingly, classmate pictures are now in order—now, not waiting for obituaries. Dr. **Andrey A. Potter**, Dean Emeritus of Engineering at Purdue University, was the recipient of the Washington Award in 1963 for distinguished leadership in engineering education and research and patriotic service in mobilizing technical knowledge for victory in war and peace. Dr. Potter has had a long and distinguished career in engineering and

education, beginning with graduation from M.I.T. in 1903. His first employment was with the General Electric Company. Two years later he became a professor at Kansas State University where he remained until 1910. Following this he became associated with Purdue University in Lafayette, Ind. He rose to the position of dean of engineering in 1913 and remained in that position until his retirement in 1953, except for a period from 1945 to 1946 when he served as president of the University. Dr. Potter has received many high awards from engineering and educational societies. He served as president of the American Society of Mechanical Engineers in 1934 and as president of the American Society for Engineering Education from 1936 to 1938. He was one of the founders of the American Power Conference, which held its first meeting in 1938. It is now the largest conference of its kind in America. Another congratulatory note of interest to his classmates has been the joyous celebration last June of Andrey's and wife Eva's 60th wedding anniversary. Their children were present to enliven the occasion, daughter Helen, a professor of finance at Loyola University, Chicago, and son James, professor of physics at Texas University. Professor Potter, now Emeritus, still has his home at 517 Russell Street, West Lafayette, Ind., and has retained his desk at the University since 1953, when not away as consultant in engineering programs at several universities and incineration and air pollution projects.

The electronic grafting of a high-speed digital computer to a unique kind of TV set has made the extraordinary result of allowing man and machine to communicate with each other through a universal language—pictures. This will reduce design and draftmanship of systems from normally months, to days and hours. It means the language barrier between man and computer has at last been broken. Known as the Electronic Design Machine, it unites the computer to television principal and revolutionizes computer technology. It has made possible the reduction of literally tons of blueprint designs—which normally are needed for the construction of Space Age equipment, into a few reels of computer tape that make thousands of individual designs instantaneously available. . . . U.S. submarines now have the unique capability of accurate navigation by seeing the heavens in all kinds of weather—while remaining beneath the surface of the ocean. Its name, the Radiometric Sextant, is now running tests by the Navy, and reports now indicate better than expected. Designed and



Andrey A.
Potter, '03

delivered by the Northrop-Nortronics of Needham, Mass., it was the result of three years and over \$4,000,000 research. It is a marvel of modern technology, making possible the precise navigation of a submarine without ever having to surface. Such a system operates basically by means of a cluster of three gyroscopes. These devices, which spin like a child's top, are unaffected by all surrounding motion and in effect establish stability in space. These gyroscopes provide constant, unwavering points needed in navigation. They substitute for the angles normally determined by taking fixes on two stars. Now, all that was needed was a horizontal reference or accelerometer that establishes a perpendicular to the earth's surface, despite the presence of tilt or roll. . . . McCormick Hall, the residence for undergraduate women students of M.I.T., will be expanded to almost twice its present size through the continued generosity of Mrs. Stanley McCormick (Katherine Dexter), '04. Howard W. Johnson, President of M.I.T., announced that an eight-story addition similar in appearance to the existing dormitory is under construction immediately east of the McCormick Hall courtyard. When completed in early 1968, this addition together with the present building will provide residential and recreational facilities on the M.I.T. campus for nearly 225 women.

Dr. Jule G. Charney, one of the world's leaders in the application of computers to weather analysis, has been appointed Alfred P. Sloan Professor of Meteorology at M.I.T. He will be the first to occupy this new chair, established through a fund pledged by the late Alfred P. Sloan, Jr., before his death early last year. Dr. Charney came to M.I.T. in 1956 as a professor of meteorology and since that time has been director of the Dynamical Weather Prediction Project. His research has carried him beyond the use of computers for forecasts into analysis of extremely complex meteorological and oceanographic data for construction of mathematical models of weather. . . . Our classmates will be pleased to learn that our industrious Alumni Councilor, **Ichabod F. Atwood**, has endeavored to continue his loyal and long-time faithful service for the coming five-year term. . . . **George E. Sibbett, II**, has a new address, 643 N. Avenida Seville, Laguna Hills, Calif. . . . Congratulations to **Adolf E. Place**, I, on December 21 at Boulder City, Nev., for his 90th birthday. —**John J. A. Nolen**, Secretary, 13 Linden Ave., Somerville, Mass.; **Augustus H. Eustis**, Treasurer, 131 State Street, Boston, Mass.

'04

The holidays are over and we can now get down to our regular routine. Those living in the warmer climates can look forward to some nice warm weather, and the others can look forward to some snow and ice. So far, here we have been very fortunate. I received some nice greeting cards this season and was particularly pleased to hear from Mrs. **Harry Rollins**,

Mrs. Bernard Blum and Mrs. Carle Hayward. Most of our classmates are now retired and feel that they have no news of interest for this column. To them I say perhaps you have a hobby or are doing something that might be interesting to our readers. Just drop me a line and I'll guarantee full publicity. I'm sure it would be pleasant reading. Please. . . . The following notices were received from the Alumni Office: change of address for **Harry G. Chapin** to c/o Mrs. Mary Low, P.O. Box 158, Grahamsville, N.Y. 12740, and **Henry Kramer**, Newfield Home, Plymouth, Mass. 02360. . . . **Charles O. Egerton** died in October 1965. . . . Seasons Greetings to you all—**Eugene M. Russell, Jr.**, 82 Stevens Rd., Needham, Mass. 02192

'05

The secretary of the class of 1901 reports in the December issue some statistics which suggest another advantage of an S.B.—namely longer life. I had suspected that might be true of our class but had never figured it out. There are 593 listed 1905 by the Alumni Association—244 graduated, 349 did not. There are now 51 of us, who graduated, still alive; 35 alive of those who did not graduate. Feeding this into my tiny little IBM machine I find that 20.9% of those who graduated are still living, whereas just 10% of the dropouts are living. This is practically the same ratio as with the class of 1901. With Ethel and **Prince Crowell**'s Christmas greeting card came the long-promised family tree. I am sure that those who knew Prince and Ethel intimately would be interested in this in full detail. If anyone wishes a copy, I will send it. Among the highlights—they have three great grandsons; two grandsons taught sailing and won several prizes, not unusual considering Commodore Prince I taught them; Prince Sears III is commodore of the University of Indiana Yacht Club and won at Detroit and Iowa last year; Indiana, of course, was first in Big Ten sailing; grandson Carl was on the soccer team; granddaughter Persis Ann and husband Jim Gessaman did research work in Alaska last summer, back at the University of Illinois in September. Ethel and Prince I (his 85th birthday December 24) drove to their winter home in Clearwater, Fla., early in January. . . . **Arthur Russell, XIII**, says, "After two years on the Beach (Miami), food poor, environment unpleasant, I am in a Methodist retirement home where the food is good and the people congenial—new address: 3227 Biscayne Blvd., Miami. I'm sure the Chamber of Commerce of Miami Beach wouldn't like it, Art, but perhaps the consensus would be that you were a martyr for two years. . . . **Charlie Smart** reports having a fine 85th birthday party at the University Club in Albany on December 19. On the 23rd he was nominated for the 41st time for the Board of Directors of the W. and L. E. Gurley Company. Again I call your attention to the fact that Charlie has the most comprehensive museum of antique

surveying instruments in the U.S.A. (perhaps outside the Smithsonian). . . . **Harry Charlesworth**'s, VI, Christmas card shows a picture of his farm in Newbury, Mass. The last I knew Harry was making regular trips from his home in North Caldwell, N.J., to the farm, driving I mean. . . . **Fred Abbott**, VI, is still dividing his time between his sons, Frederick in Brockport, N.Y., and Bill in Longmeadow, Mass. Bill is chief engineer and auxiliary sales engineer for the new nuclear energy power plant at Rowe, Mass. Bill designed this plant and supervised construction while he was with Westinghouse. Fred's address is Meadows Apt. 306, Ellis Rd., Brockport, N.Y. 14420. . . . I was quite amused in reading the personal message on **Huntington Smith**'s Christmas card. He says that he and **Charlie Dean**, George Jones, Howard Cowper, Bill Gouinlock, **Bob Clark** and **Jim Lambie** used to take a snowshoe "breather" at mid-term at Wonolancet Intervale, N.H., near Mt. Chocorua. Well, that is just about in my front yard. I look north into the Sandwich Range, beginning with Chocorua on the extreme right, then Paugus, Whiteface, Trypyramid, Sandwich Dome, Israel, etc. with the Squam Range to the far left. It's the most beautiful panorama in the U.S.A. Come up and see me sometime. . . . Change of address: **Edward T. Steel**, 4535 Howard Ave., Weston Springs, Ill. 60558; **Frank H. Langworthy**, II, Lee Nursing Home, 222 Bacon St., Waltham, Mass. 02154; **George H. Barrows**, IV, 29 Wyndybrook Lane, Madison, Conn. 06443; **Silas P. Cumming**, 962 State Rd., No. Dartmouth, Mass.—**Fred W. Goldthwait**, Secretary, Center Sandwich, N.H. 03227; **Gilbert S. Tower**, Assistant Secretary, 35 No. Main St., Cohasset, Mass.

'06

As reported in the February notes, the varied and beautiful cards kept coming and many of them contained some welcomed notes and news—thanks a lot! The card that gets the award for the greatest distance came from Greece, from **Henry Mears** who said he had planned to go to Beirut but was afraid that the unrest there would spoil the trip. Where did you go Henry? . . . Although their card came from Bronxville, Katherine and **George Burpee** had been circling the globe, or some of it, as they were "just back from a trip to Australia, Hong Kong and Japan. The primary purpose was the dedication of Hammersley Iron Ore Mine in Australia, owned 40% by Kaiser Steel. We took a roundabout route home." . . . **Eleanor Manning O'Connor** was "Sorry to have missed the 60th reunion. Still not on the Leisure World list and never I trust. In Laguna Beach for Christmas and back to Boston for New Years." Their card interested me very much. It shows a painting by Joseph Lindon Smith of a detail from Temple of Seti I at Abydos, Egypt, and tells "how come." In an auctioneer's window last June we chanced on a book by Joseph Lindon Smith who devoted his life to putting on canvas the

spirit of ancient sculpture. His book *Tombs, Temples and Ancient Art* describes not only his personal life on the Nile but gives a vivid account of Egyptian archaeologists at work. With this introduction we added to our library Reisner, Wm. Stevenson Smith, Petrie and others. Learning of our interest, Wm. Stevenson Smith, Curator of Egyptian Art, Museum of Fine Arts, Boston, showed us several of Joseph Lindon Smith's originals and suggested an exhibition of his work at the Johnson O'Connor Research Foundation in New York. . . . A fine example of photographic art was on the card from Agnes Coes, a typical winter scene with an old-time locomotive pulling a long line of freight cars, like previous similar ones by **Kent Coes**. Agnes said, "Your card and note filled me with such happy memories I could hardly bear it! But I am so glad to hear from you and have the sketch of dear old Tech. I have slowed down but am well and busy. That is the only remedy. I am very near 86." . . . Mary and **Harry Fletcher** had recovered from our reunion. Mary had troubles of one kind or another during their visit to Harry's home town of Portland, Maine. That is also the home town of **Gene Fogg**, although he and Lynne like to be out in the harbor, on Peaks Island. Last June they were having extensive alterations made there but came to our reunion nevertheless, and then both were ill and so missed our gatherings. Gene had a long letter on their card and sent a check for the Alumni Fund. . . . **George Guernsey** gets his cards off early in December, but he didn't say whether he would be with daughter Mary for the holidays. As previously reported, George has an apartment in the Plymouth Harbor at Sarasota and says, "Look me up if you are down this way." So why don't you Florida sojourners drop in on George. . . . Awhile ago a change of address came through for **Ernest M. Smith** who had lived for years in Old Chatham, N.Y., on Wildbore Farm, and had recently gone down to Edgartown on Martha's Vineyard, with Mrs. Smith. Answering a question on our card to them, Ernie enclosed a long letter about that Wildbore Farm. He said, "The first Wildbore, Sam, settled there on 10,000 acres (?) from King George in the early 1600's. Since then each first son in succeeding generations was named Sam except my wife's father, Thos., who moved to industry in New Britain where he married Grace Stanley. In 1919 **Phil Stanley** ('06 deceased) asked me to join the Stanley Rule & Level Company, and I lived in New Britain for 20 years, retiring to Old Chatham where I lived for 21 years until the place was sold in July 1966." In Edgartown they bought "the lovely Episcopal Parish House." His son Dick and wife Cynthia have two daughters who are the 12th generation in the Wildbore line. Dick graduated from Cornell in 1950. Ernest allowed he was enjoying life at Edgartown, especially in the summer when some 40 New Britainers spend their vacation there, "which helps a lot, especially with golf and cocktail parties. I feel very fit going on to 84 and fortunately never give a thought about the future—except to the liquor stock. Do stop by if

you are down this way." . . . Helen Ruggles' card showed a sketch of the birthplace of Clara Barton, and I had to consult an authority to locate it. I found that she was born in 1830 in Oxford, Mass., which is south of Worcester a few miles above the Connecticut line. Did you remember that after her Civil War experiences and similar work during the Franco-Prussian War, etc., she founded the National Red Cross in 1881? In 1965-66 it was supported by 30½ million adult members. The Far West sent a report as **Fay Libbey** wrote, "I read the class notes in the November Review with great interest, and they brought me rather close to the Reunion. **Guy Ruggles**, Henry Mears and I had a short get-together here when Guy passed through on his way to Boston." Following Guy's card came a long letter from Phoenix where he expected to stay for awhile. . . . **Jim Wick, Jr.**, maintained that he and Clare were "still tottering" and enclosed the Medicare version of that baffling tour through door after door, eventually taking the one marked Republican and falling nine stories into the alley. . . . **Jack Norton** said he was "going along fairly well just now. It's no fun getting old." And **Bill Abbott** and Andrea wished us a healthy winter to be in shape for the reunion in 1967. That seems to be a good note on which to end these notes, for Alumni Day, Monday, June 12, will be only three months away. You could be making plans to join us then—what say?—**Edward B. Rowe**, Secretary-Treasurer, 11 Cushing Road, Wellesley Hills, Mass. 02181

'07

This is the year of the 60th Reunion of the class of 1907, M.I.T., to be held between June 9 and 12, the 12th being Alumni Day. In December I sent out 90 questionnaires asking for replies to be in not later than January 6. As I write these notes on January 11, the deadline for the March Review copy, I have recorded 38 replies. Fifteen class members have signified their intention to attend "if possible." Twelve have indicated their choice to hold the Reunion on campus for three days, Saturday, Sunday, and Monday. Four would like to make it a one-day gathering on Alumni Day. I no doubt shall hear from additional members, but this gives you a trend of what the men wish to do. The request for financial aid to carry on the work of the Secretary-Treasurer has brought in \$220 so far. I expect this will be substantially increased as I hear from additional members. . . . Professor **Ralph G. Hudson**'s questionnaire was promptly returned by his son, Gerald C. Hudson, '34, with a note that his father was completely bedridden; and he sent his regrets that he would not be able to attend the Reunion but wished to send Christmas greetings to all the class. On opening the Boston Herald on Tuesday, January 3, I was shocked to read a rather complete obituary notice that Ralph had died on January 1. **Ed Lee** thoughtfully sent an obituary notice from the *Fort Myers News Press*. Ralph was a

native of Lawrence, Mass., but lived for many years in Newton Center. After graduation in 1907, he joined the Faculty of M.I.T. and served that Board until he retired in 1957 as Professor Emeritus. He became well-known for his writings which included, *The Engineer's Manual*, *Engineering Electricity*, and *Introduction to Electronics*, as well as other technical publications. During 1917-18 Ralph was director of research for the Electric Welding Commission at the Emergency Fleet Corps. He was a Fellow Member of the American Association for the Advancement of Science and of the American Institute of Electrical Engineering. He was also a member of the American Association of University Professors. For 20 years Ralph had been a winter visitor to Fort Myers, Fla., and a permanent resident there for the past four and a half years. One son, Julian L. Hudson, is County Commission Chairman in Fort Myers. Ralph lived with another son, Gerald C. Hudson, '34, at 101 Fairview Avenue in Fort Myers. A third son, Perry M. Hudson, lives in Weston, Mass.; and a daughter, Priscilla Hudson, in Munson, Mass. He had ten grandchildren and nine great-grandchildren. Private funeral services and burial were held at Chatham on the Cape. . . . Here are various address changes you should make on your Roster of Living Members of the Class of 1907, M.I.T.: **Warren I. Keeler**, V., add zip number 06320; **William G. Perry**, IV, 67 Central Street, Andover, Mass. 01810; **Allston K. Thorndike**, XIII, 131 Park Drive, Boston, Mass. 02215; **James H. Fenner**, VI, an associate member, has moved to 57 Broad St., Lynn, Mass. 01901. . . . A note from the Alumni Register states that **John A. Davis**, III, who lived at Siasconset on Nantucket Island, died on May 23, 1960. I will have to make a further report on this in the April notes. No mail has been returned to me indicating his decease. . . . The following news items I gleaned from the replies to the 60th Reunion questionnaires: **Harry R. Hall** has had a great deal of trouble with his eyesight but is to undergo surgery shortly which he expects will enable him to get around again. . . . **J. M. Baker** will plan to be with us this year for the Reunion. Usually he cannot, as graduation at Northwestern University is at the same time as M.I.T. Alumni Day. . . . A very interesting letter and photograph from **Willis G. Waldo** tells of his work at Palm Beach, Fla., and in Latin America. Willis is one of our octogenarians who is still very active in business.

. . . **Otis G. Fales**, II, writes, "At present I am hospitalized following an automobile accident, but am improving slowly." He included a new address, 7312 Boulevard East, North Bergen, N.J. 07047. . . . **Kirk W. Dyer**, X, plans to attend his 65th alumni celebration of the class of 1902 at California Tech in Pasadena, Calif. He and **Jim Gaylord**, VI, are the only surviving members of this class. Jim, at present, is in a nursing home. . . . **E. Stanley Wires**, IV, finds he has to revamp his life after a wonderful 58 years of married happiness. Mrs. Wires passed away last October. Now he will center his attention on 22 children, grandchildren, and great-

grandchildren. As of the end of last December he entirely and completely retired from active business. . . . Mrs. **Paul Cummings** wrote to me for Paul, whose eyesight is too poor to permit him to do so. The Cummings family left on January 7 for their 7th trip abroad together. They will spend most of their time at Mallorca, Spain. They first flew from Boston to Wilmington, Del., to spend Christmas with a married daughter, then to Millburn, N.J., to visit Paul, Jr., class of 1950 M.I.T. Their younger son Bob is with the Boston Chamber of Commerce in the Convention Bureau. He went to Boston University and lives at Scituate, Mass. . . . **Fred Dempwolf** says he has now entirely retired from architectural practice and to pay no attention to the letterhead on which he wrote. . . . **Walter B. Kirby**, IV, says that he does a little gardening in season and also does some painting of landscapes in order to keep out of mischief. Mrs. Kirby passed away last June. . . . Mrs. **Helen E. MacGregor**, wife of **Milton E. MacGregor**, VIII, died suddenly at their home on Lower Road, Brewster, Mass., December 27, 1966. Due to a snow storm, your Secretary did not attend the services as he wished to do, which were held in the Brewster Baptist Church.—**Philip B. Walker**, Secretary and Treasurer, 18 Summit Street, Whitinsville, Mass.; **Gardner S. Gould**, Assistant Secretary, 409 Highland Street, Newtonville, Mass.

'08

Bill Booth, our class Agent, has sent me copies of notes he received from **Frank Sharman** and **John Mullen** during the Christmas holidays. Frank had heard from **Lester Carter**, **Monroe Ames**, **Myron Davis**, **Arnold Heath** and **Ralph Battchelder**. Mullen is staying with his youngest son in Stokie, Ill., and has nine grandchildren, two girls and a boy in each family. . . . We are sorry to report the death of Captain **Herbert A. Ellis** of Medford, Mass., on June 12, 1960. . . . How about some news. I'd certainly appreciate hearing from you.—**H. L. Carter**, Secretary, 14 Roslyn Road, Waban 68, Mass.; **Joseph W. Wattles**, Treasurer, 26 Bullard Road, Weston 93, Mass.

'09

In the February Review we told of **Steve (Joseph N.) Stephenson** having resigned as editor-in-chief of *Pulp and Paper Magazine of Canada*, a post which he held for fifty years, and that he and Mrs. Stephenson had retired to live in Wolfeboro, N.H. We asked him to tell us something of his activities there. He writes: "This is in reply to your S.O.S. of December 20. Your guess that I have been roped into community activities is a bit off the mark. At 84 I am taking it easy. My only steps in that direction have been to join the Rotary Club and the local Congregational Church. It seems that my fifty years as editor of the *Pulp and Paper*

Magazine of Canada set a record in that field. And my thirty years as Cubmaster may have been another. It may interest you to know that Wolfeboro was named after General Wolfe who led his British army through here on his way to Quebec where he defeated the French and won Canada for England. Another interesting bit is that General John Wentworth, Colonial Governor of New Hampshire, had his summer home in Wolfeboro, and several bricks from his house are now part of the chimney of our summer cottage." Steve also enclosed a short poem by himself, "A New Spring," which came from his company paper and is as follows: "The woods are bleak and beautiful/The spruce trees great with snow/The western sky is wonderful/A light with sunset glow/The snow has fallen, more on more/And now the drifts are deep/Beneath its fluffy comforter/The earth is fast asleep/But nature in her restlessness/Ere long will wake some morn/And then with startling suddenness/A new Spring will be born." . . . We also received a letter from **Julius Serra** from his home in Princeton, N.J. Julius wrote: "I have just been looking at the *Technology Review* for November and noted your letter. On account of a physical condition which culminated in an operation, I was not in condition to attend the last Alumni Day. So I missed the talk by Mrs. Compton, unfortunately. Speaking of birthdays, on May 15 my friends and relatives celebrated my 80th birthday by throwing a party for me! They also gave me an unexpurgated edition of *Arabian Nights* translated by Richard Burton, and I had all those at the party sign on one of the blank pages of the first (of three) volume! I was interested in the article by Cowen on the Mohole principally because I remembered Jaggar's lectures on geology. They were so popular that it was necessary to keep out men who did not belong in the class. I was not so keen about the Mohole anyway. I have nearly completed my autobiography! I know almost nothing about my grandparents, so I thought why not leave something for my grandchildren?" (Julius suggests a file of every member of the class but we see no way of accomplishing this.) We missed Julius last Alumni Day since he is always so regular in attendance. We will be looking forward to seeing him next June. The class also congratulates him on his 80th birthday and the fact that his friends and relatives took appropriate notice of the event.—**Chester L. Dawes**, Secretary, Pierce Hall, Harvard University, Cambridge, Mass. 02138; **George E. Wallis**, Assistant Secretary, Wenham, Mass.

'10

I am sorry to report that **W. Philip Doerr** of Whittier, Calif., passed away on October 25, 1966. . . . **Carroll Benton** and his wife Ann sent Christmas and New Year's greetings. . . . **Jack Babcock** reports that, "Nothing of importance has taken place with me. I still lunch regularly with **Fred Lufkin**, a habit we started in the spring of '65 when we were arranging for

our 55th Reunion." . . . I had a very pleasant surprise during the past holidays. Jess and **Harold Akerley** called on us at our home, and we had a very pleasant visit. Harold and Jess look extremely well although Jess has to be very careful as she has had a heart attack. . . . **Walter Spalding** writes from Hawaii: "Best wishes to you from the crossroads of the Pacific. We were happy to return home from over four months on the East Coast (except only Boston) and seven weeks divided between a busy time in London and a restful stay in Estrel, Portugal, two of the best places in Europe nowadays. We hope next summer will take us to Boston and that we shall see you there." . . . **Kenneth P. Armstrong** has been presented a plaque by the City Commission of Opa-locka, Fla., which bears the following inscription: "Presented to Kenneth P. Armstrong by the city of Opa-locka in grateful recognition of nine years of faithful and valuable service as a member of the city's Planning Council, December 7, 1966."—**Herbert S. Cleverdon**, Secretary, 120 Tremont Street, Boston, Mass.

'11

A letter from **Aleck Yereance** which came in early December tells of his five-year struggle to get town water into his summer home on Old Wharf Rd., in South Harwich, Mass., which culminated successfully in November just when a neighbor's well went dry and he was afraid his would. A clipping he sent along about Professor **Harold Babbitt** follows: "Harold E. Babbitt, Professor Emeritus of Sanitary Engineering at the University of Illinois, has been named senior staff consultant with Henry P. Jones & Associates, Bellevue, Wash. He has also been appointed as special consultant to the Department of Civil Engineering at the University of Delaware. Professor Babbitt joined the U. I. staff in 1913 and served until 1964. Since then he has been a consultant in this country, Brazil, Korea, and India, and has written several textbooks. He is currently in private practice in Seattle." A nice letter from Professor Babbitt himself confirmed the truth of all this. . . . **Roy MacPherson** had a cataract removed from his second eye in early December, and at Christmas time was waiting out a long period of inactivity. . . . An incorrect address for **Jim Campbell** was given in the November notes. It should have been c/o Eadie, Freund & Campbell, 257 Park Ave. South, New York, N. Y. . . . **Gertrude** and **O. W. Stewart** left just after Christmas for a visit with their youngest son who is on the staff of the Kenyatta Normal School in Nairobi, Kenya. They spent a couple of days each in Rome and Cairo before going on to Kenya. . . . **Marjorie** and **L. G. Fitzherbert** are spending the winter in Mallorca where they have been a number of times. . . . The annual letter from **Ollilie** and **Paul Cushman** came just after Christmas. They are as active as ever. Paul is still consultant for L. & S. Bearing Company, and occasionally an expert on the cause of auto accidents. He is keeping up his work in

Masonic circles and the Descendants of the Mayflower. Their big activity was with square dance clubs. For this purpose they traveled all over this country, into Canada and with a large group of square dancers to an international festival in Mannheim, Germany. After the festival they continued their European tour through France, Switzerland, Italy, England and Belgium. . . . A letter from **Allston Cushing** of Kansas City said he and his wife are in the best of health. They had their daughter and her family with them for Thanksgiving and went to the daughter's home in Tulsa, Okla., for Christmas. In between, the serious sickness and death of their son's mother-in-law took them to Colorado Springs. They get around. . . . Because of a goof I made a couple of months ago, I have a letter from **Roy Van Alstine** by way of the *Review* editor. You remember, I incorrectly told of his death. After three years at M.I.T. he took his final year at Stanford. He worked for Los Angeles on harbor development, for several years as plant engineer for Southwestern Shipbuilding Company and then became city engineer for Long Beach. In 1927 he opened his own civil and structural engineering office in Long Beach and continued in active practice until retirement in 1956. He and his wife have traveled extensively including trips to Alaska, South America, Australia, the Orient, the Near East, five times to Europe and once around the world by ship.—**Oberlin S. Clark**, Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

'12

Belated word has just been received from the Alumni Office of three deaths that I do not remember having previously reported. **Walter M. Ruby** died nearly a year ago at Lakeland, Fla. . . . **Robert R. Langee** passed away at his home, 60 Avon Street, Somerville, Mass. . . . **Gerald M. Keith** died in Gainesville, Fla., over a year ago. . . . A good letter from **William V. Schmiedeke** of 741 Stewart Avenue, Los Angeles, Calif., reviews a very active life since graduation. Bill started 38 years ago in the Midwest in general construction for miscellaneous private and public works working up from timekeeper to vice-president and chief engineer of the Penkey Construction Company, Cincinnati, Ohio. He was then for five years bridge designer with the New York Central Railroad. He lists a variety of very interesting connections from 1950 to the present time, all in construction and engineering fields. At the present time he is cost estimator for Adrian Wilson, Architect of Los Angeles. He certainly has lived a busy, interesting life and is still at it. . . . **Milton Kahn**, who has always been actively connected with Jewish philanthropies, was given a testimonial dinner recently by Brandeis University for his efforts in forming the Foster Alumni Association. Brandeis, a young school, found it necessary to interest graduates of other schools in their alumni program, and Milton did a fine piece of work for

them. At the present time Milton is also serving as National Chairman of the Jewish Appeal.—**Frederick J. Shepard, Jr.**, Secretary, 31 Chestnut Street, Boston, Mass. 01945; **John Noyes**, Assistant Secretary, 3326 Shorecrest Drive, Dallas, Texas 10145

'13

March is the month for "South of the Border," when the 19th Annual M.I.T. Fiesta in Mexico will be held on March 9th, 10th, and 11th. If any of you are interested in attending this very special event, contact by airmail or wire Armando Santacruz B. at the M.I.T. Club of Mexico City, Reforma 116—804, Mexico 6, D.F., Mexico. . . . Once again we must report the passing of another loyal '13er. **George W. Duncan**, Royal Oaks Manor, Apt. A22, 1763 Royal Oaks Drive, Duare, Calif. 91010, died on September 22, 1966. The class of M.I.T. 1913 extends to Duncan's family its most sincere sympathy. We would appreciate further details concerning George's accomplishments and events of his life. . . . We hope that all of you loyal '13ers are making your donations to the 1966-1967 Alumni Fund. Your Scribe was chairman of the drive last year in Canton. I have been informed or selected to assist the Fund Committee as chairman of our region: Canton, Foxboro, Easton-dale, North Easton, South Easton, Mansfield, Sharon, and Stoughton. . . . Several of our classmates are on the move; changes of addresses are **Robert D. Bonney**, 360 Forest Ave., Apt. 601, Palo Alto, Calif. 94301; **Alfred H. Parthum**, G-4, Division Headquarters, USARAL, APO, Seattle, Wash. 98749; **Roy A. Randall**, Peaks Island, Maine 04108. . . . We must congratulate John I. Mattil and the rest of the Review staff for the improvements in each issue. . . . We shall turn to the biographies. **Stuart J. Eynon**, 285 Webster St., Needham Heights 94, Mass., was very brief, but he called us for the error of 1966 instead of 1963 for the year of our 50th Reunion. . . . **William Newsome Eichorn**, 91 Beach Bluff Avenue, Swampscott, Mass. 01907; his wife is Dorothy, and he states, "Good to hear from you, Phil; hope you are all well and everything is going okay. Our best to you both." . . . **Harold D. Marsh**, 336 S.E. 49th Avenue, Portland, Ore. 97215; wife, Laura R.; children: Kathleen, Robert D.; grandchildren: Ted D. . . . **Ellis W. Brewster**, Warren Avenue, Plymouth, Mass. 02360; wife, Ellen H.; children: William S., Lois B. Withington, Spencer H., Lydia B. Toll, Benjamin B.; grandchildren: there are 21, too many to list the names; great-grandchildren: two. Bill wrote that while on a vacation in October he had another slight heart attack and was hospitalized at the Memorial Hospital, North Conway, N.H., for about 10 days, but returned then to Plymouth. His activities will have to be somewhat circumscribed for a time. Have just talked to Bill over the phone, and he is back in his usual good health. He and Ellen are planning a trip in the latter part of February. . . . **Samuel E. Rogers**, 808 Freeling

Drive, Sarasota, Fla. 33581; wife, Margaret V. Rogers; children: none. . . . **Bion L. Pierce**, Mill St., Myricks R.F.D. Assonet, Mass. 02702; wife, Phebe C. Pierce (since deceased); children: Estelle Dow, Cynthia Trites, Bion C. Pierce, 2nd; grandchildren: Caroline Parker, Robert Dow, Erie Trites, Toni Trites, Laurel Pierce, Stephe Pierce, Kathryn Pierce; retired—no company problems; activity: hobby, boating. . . . **Wm. George Mac-Tarnaghan**, 604 Mountain View Avenue, Bluefield, W.V. 24701; wife, Alva R. Mac-Tarnaghan; offspring: none; retired, like to travel, also sketching and painting. . . . **Harold E. Crawford**, P.O. Box 497, Walla Walla, Wash.; wife, Mary; children: Martha C. Gray; grandchildren: Gary Gray, Jane, Betsy, Peggy Harris; vice-president Tom-A-Lum Lumber Company, president White House Crawford Company. . . . **Kenneth B. Blake**, 7634 114th Place, S.E., Renton, Wash. 98055; wife, Hazel; children: Anne and Walter (M.I.T. '59); "With this climate and location there's plenty to do, gardening the year round and thousands of beauty spots to see and photograph. Every summer finds us camped in one of the national parks or forests for a week or more. And nearly every weekend we trip to lakes, back in the mountains. Snow may be 16 feet deep, but the roads are kept open for the skiers. Here's to your good health. . . . **Eugene L. MacDonald**, R.D. 1, Pennington, N.J.; wife, Mary. . . . **Burton L. Cushing**, 214 Howard Street, Rockland, Mass. 02370; wife, Florence G. Cushing; children: Donald L. Cushing; grandchildren: Carol C. Cushing, Cynthia L. Cushing; activities: teaching physics and math at Fisher Junior College, Boston; chairman Rockland Library Trustees; member of Executive Committee of Rockland Chamber of Commerce; president of a Schoolmen's Club in Boston; real estate management on side; hobby, tinkering. . . . **Howard S. Currier**, 103 Hacienda Carmel, Carmel, Calif. 93921; wife, Evelyn C. Currier; retired late in '51 after six years with Ford Motor Company, and 23 years with General Motors Corporation; to California to live in late '53; West Coast locations thus far: Arcadia, Santa Barbara, Carmel; present activities: chiefly lawn bowling (daily), and control bridge." . . . **Gardner R. Alden**, 15 Hillcrest Road, Framingham, Mass. 01701; wife, Alice Hodgen (Wheaton 1913); children: Ruth and Priscilla (both Simmons), Gardner (M.I.T. '44); 13 grandchildren: Alden (Wesleyan '66), David (U. Conn. '67), Peter (U.N.H. '67), Debbie (Cornell '69), others in high and grade schools; 4 great-grandchildren; "retired, library trustee; fishing and music are hobbies." . . . **David V. Nason**, 7031 North Belmont Lane, Milwaukee 17, Wis. A very interesting but humorous treatise was received from Dave. He appears more concerned with the selection of a site for our 55th Reunion than his more intimate family accomplishments. His personal specifications and requirements for the selected site and facilities will be given careful consideration by the 55th Reunion Committee. We shall nominate Dave as the class humorist. Also, one of the main events will be a 100-yard dash for those attending the Reunion to

prove their physical fitness. From our observance Jonathan Winters or Myron Cohen could use Dave as a by-line writer. . . . **Ellis W. Hartford**, 66850 Avenue, 18 North Palm Springs, Calif. 92258; wife, Louise. He is retired. . . . **Henry H. Thompson**, 104 Elm Avenue, Takoma Park, Md. 20012; wife, Sarane; son, Henry H. Thompson, Jr.; he is retired. . . . **Robert Schulze**, Triton Drive, RFD 1, Rye, N.H. 03870; wife, Estella May Schulze; he has retired. . . . **Arthur E. Hirst**, P.O. Box 83, Swansea, Mass. 02777; home, 23 Alyce Avenue, Somerset, Mass.; retired from Standard Chemical Products, Inc., Hoboken, N.J., but acting as a consultant; wife, Julia; activities: washing dishes, shopping for Julia; no hobbies except to try to pay bills and taxes, and voting Republican. . . . **Leroy R. Block**, 501 South Avenue, Pittsburgh, Pa. 15221; wife, Mildred; he is retired and plays golf and does painting; "Nice to hear from you, Phil. Would be nice to see you, but I never seem to get to or near Boston." . . . **George R. Wallace**, 98 Prospect Street, Fitchburg 01420; Alice G. Wallace is his wife; activities and hobbies: race horses and antique automobiles, also he is president and treasurer of Explorer Research Corporation. . . . **John B. Welch**, 6950 Central Avenue, Indianapolis, Ind. 46220; wife, Frances D.; children: Mrs. W. J. McLane, Indianapolis, Ind., five children, and Mrs. W. M. Mooney, Cincinnati, Ohio, three children; retired from Standard Dry Kiln as president and chairman of the board; belongs to the Scrente Club and the Highland Golf Club; hobby is golf. . . . **William G. Horsch**, 224 Briar Hill Lane, Woodbury, N.J. 08096; wife, Helen Gertrude; children: Mrs. James W. Garrison, Mrs. C. H. Lightbody; grandchildren: Robert, Charles, Alan Garrison, Laurie Ann, James Lightbody; activities: church (finance ground committees) and continuing operation of a small retail furniture business inherited from my father; hobby: letterpress printing. . . . Received a short note from Mrs. Daniel Ricker: "Sorry to inform you that **Daniel Ricker**, M.I.T. Class of 1913, died November 1, 1966. He is survived by his wife, Winifred Howland, and two sons, Dr. Bernard H. Ricker and Thurlough G. Ricker." The class of 1913 extends to Mrs. Ricker and her two sons the most heartfelt sympathy. . . . Until next month "Keep the Faith."—**George Philip Capen**, Secretary and Treasurer, 60 Everett Street, Canton, Mass. 02021

'14

As this is written the New Year has just past. We know it is the New Year because **Paul Owen** has just sent us, as usual, his real estate business calendar blotter which will adorn our desk for the next 12 months. We are glad to see this as evidence that Paul is still going strong and presumably surviving those 700 pounds of smog and dust annually which we are told is the lot of those who still insist on living in or near the big city, or is it the fun city? When you need a real breath of fresh air and some unfiltered sunshine,

please come and see us in Maine, Paul. . . . **Alden Waitt** notes with satisfaction that the December Review has no '14er listed under Deceased. "Nice going, Herman; let's try and keep it that way, and a happy New Year to you and '14." We'll try to do our best Alden, but we have surely come a long way down hill to get too much satisfaction out of being merely alive. . . . We have a couple of address modifications: **J. Leslie McKeague**, 1679 Shirley Ave., Petersburg, Va. 23803; also **James F. Morgan**, 2406 Armstrong Street, Honolulu, Hawaii 96822. . . . M.I.T. President Johnson makes an excellent point when he states, "Its basic propositions make M.I.T. a university that never looks back as a conservator of the past but always forward as a maker of the future." This we are proud to say is the philosophy of the organization with which we spent just about our whole professional life. But we surely have to be careful how we try to predict the future, not so much in the field of physical things but in the broader and particularly vulnerable field of international relations of homo sapiens. And I hope you will forgive this bit of reminiscing about an incident that happened while we were a research assistant at M.I.T. some 50 years ago, associated with Professor Arthur E. Kennelly of Harvard and M.I.T. Professor Kennelly was a man of wide interests and talents, probably the best known in the country in the electrical field, and our association was very profitable, at least to me. At the time there had just been announced the successful radio telephone transmission across the Atlantic. I can remember quite vividly being with Professor Kennelly en route to a meeting where he was due to deliver a talk. He turned to me as we travelled and said, "Herman, now with the ability we will have to talk all over the globe, when our voice will only be delayed about one-fourth of a second, what a wonderful thing that will be to insure peace all around the globe." And we have only had two world wars and the development of the most refined instruments of destruction in the last 50 years! Ho Hum. . . . The last time I saw **Les Hamilton**, he said he thought I ought to tell more about my own doings besides trying to carry on this secretary function. Well, someday when I feel real philosophical and expressive, I may be able to paint a proper picture of social life in a town of 300 when the town meeting is the important political function of the year. I will leave this until sometime when there is nothing better to write about. I am tempted, however, to dwell upon another aspect of my doings in connection with M.I.T., namely interviewing prospective candidates who have applied for admission to M.I.T. I have been doing this for many years (as I know some of you have also done), first in New Jersey before we moved to Maine. We lived in a typical big-city suburban area, and where interest in M.I.T. on the part of the school graduates, or possibly their parents, was a weak runner-up to Dartmouth, Yale, etc. When we moved to Maine about 10 years ago, we were asked to continue the educational counselor function in the general area of the center of Maine. We have candidates

to interview who drive close to 100 miles. The interest in M.I.T. here is real. The qualifications of the prospective students range widely. The present-day scholarship aspects of the admissions are in general very important. Not too many who apply, however, have the necessary high college board examination ratings to make it. So a large part of the contact I have with the candidates is to try to offer general advice. I find this very satisfying and seemingly appreciated by the candidates, and usually one or more of their parents whom I see after I have interviewed the candidates. I suppose contact with young people is one way of keeping young. To repeat, the range of qualifications of the prospective students is wide, and not many whom I see make the grade. But on the other hand, the few who do make it are often very, very good. I must admit getting quite a kick out of talking to a young lady recently, a member of a large family, who had her future all planned—M.I.T. for her S.B., then M.I.T. for her Ph.D. and a career in industrial science. And I must confess that I have a strong feeling she will make it. My interest in detailing this story is to give backing to the Alumni Fund, which plays a large part in supporting the present-day admissions scholarship system. This, as you know, means if you can make it scholastically via high college board exam marks, the scholarship arrangements are ready for you. . . . A few contacts recently: a note from **Charlie Fiske** on his way to Florida for the winter with Mrs. Fiske, also a word with **Florence and Harold Richmond**, just returned from a visit with their son in Rochester, Minn. Harold's arm and shoulder are well healed now. He will try to get to the monthly Alumni Council meeting at the end of January when **Les Hamilton** and **Harold Wilkins** are usually also present. And by the way, you men within range of Cambridge are always welcomed guests at these dinner meetings the last Monday in the month at the Faculty Club where the food is good and the speakers the best, and not too long. Drop a note to the Alumni Council for a reservation (\$3.75 for meal) or let me know.—**Herman A. Affel**, Secretary, Rome, Maine. Mail: RFD 2, Oakland, Maine 04963

Deceased

AMBROSE WALKER, '91, January 10
ROBERT A. DAVIS, '96, January 6*
CLIFFORD S. DEWIS, '04, November 22
ALBERT E. SWEETSER, '05, January 15
FRANK LOGAN, '06, July 17
RALPH G. HUDSON, '07, January 1*
ERSKINE P. NOYES, '07, January 17
RIDGWAY M. GILLIS, '10, October 24
EARL E. FERRY, '12, January 29
GERALD M. KEITH, '12, July 19, 1965
JOHN T. SCOGIN, JR., '12, July 16
DANIEL RICKER, '13, November 1
THEODORE H. KRUEGER, '14, November 3
LYLE M. RICHARDSON, '14, December 23
WILLIAM J. BARRETT, '16, January 21
PERCIVAL P. GOODING, '16, December 22*
ALLISON R. WILLIAMS, '17, August 27*
JOHN R. LONGLEY, '18, October 26
THOMAS L. GOODWIN, JR., '19, November 24

'15

From Greenland's icy mountains to India's coral strands, 45 supreme classmates made our Christmas happy with attractive cards. A dozen more from families and our M.I.T. reading public warmed our hearts with their friendly messages. After five weeks **Phil Alger** left the hospital here for his home in Schenectady, and we wish him a comfortable convalescence. When I saw him last, he gave me the annual Christmas poem that Helen and he compose. Phil's active mind was beginning to stir again, looking for new problems to solve. . . . **Sam Berke** was laid up in November and December, returning to his office part-time in January. To Sam, Phil, Eastie, Reggie and Chet, and any others who have been having a tough time of it, go all our best for quick and complete recoveries. . . . **Eastie Weaver** is still seriously laid up, but through his son Jim, '43, he sends "love to all." . . . Our Lowell twins have had more than their share. **Reggie Foster** is back at home, but **Chet Runels** has been seriously sick in the Lowell General Hospital. Christmas card messages: instead of going cruising Alice and **Herb Anderson** plan to stay at Pompano Beach until April. They were on Cape Cod and in Maine last summer. . . . **Wayne Bradley** invited us to his Moosilauke Inn for next summer, and this is the year we'll take advantage of his kind offer. . . . The **Ken Boyntons** found Florida too cold last year, so in January they went on a South Pacific cruise, where we know from our trip down there in 1963 that they will find it hot and comfortable. . . . Thanks to **Maurice Brandt** for his holiday wishes to "the class Secretary supreme and his wife." . . . Beulah and **Earle Brown** said they were glad to hear from us after their Hawaiian trip. . . . What price hard work. **Whit Brown** wrote, "I got myself into a very busy town (Concord, Mass.) situation, ending in a special town meeting December 5th at which my projects were overwhelmingly approved. But I was about done in by it all so took off for Florida as soon as possible. I had lunch with **Herb Whitcomb** who is

AUSTIN J. O'CONNOR, '19, December 25,
1965

MAURICE H. ROLE, '19, January 26, 1965
GEORGE H. BURT, '20, September 19
HENRY M. LEIGH, '20, October 25
FREDERIC B. DADMUN, '21, January 2
OSCAR B. SIAS, '21, December 3
MARVIN W. MAXWELL, '23, August 28
DOUGLAS F. ELLIOTT, '24, January 12*
ROBERT D. FOSTER, '24, December 26*
HARRY STEINBERG, '25, January 5
CHARLES R. WEXLER, '25, January 12
FRANK J. CRANDELL, '27, January 19
WILLIAM H. CARLISLE, JR., '28, January 23
JOHN A. RUSSELL, '28, December 28*
MYRON F. BURR, '31, December 22
MISS LOUISE JORDAN, '31, November 22
FREDERICK R. KLAUCK, '38, December 25
MAYNARD K. DRURY, '39, December 10
PAUL H. GOODMAN, '54, November 12*
*Further information in Class News.

better but still rather weak." . . . **Jerry Coldwell** still keeps going, this time instead of up in the air he was under the ocean. "Glad that you moved the N.Y. meeting from January to April. At least from my own point of view it works out a lot better. Just returned (12/15) from a trip to the NORAD (North American Air Defense) Command in Colorado Springs, Colo. It is located 1,500 ft. below (inside) the top of Cheyenne Mountain near Colorado Springs. Went out on one of the nuclear Polaris subs from Norfolk, Va., a few months ago and that was an interesting experience also. We expect to be in Florida February and March, and if you get down we would love to see you." . . . **Henry Daley**: "Glad to get your card. I'm tickled to know that the New York dinner will be held in April rather than January. January brought forth too many cancellations on my part from either the weather or demon bugs. Talked with Andy over the phone recently. He sounded quite cheerful and well considering all he has gone through the past eight years. Give my best to the 'boys'." . . . Helen and **Otto Hilbert** continue their exciting travels: "We have had a full year. In the spring we toured the West Indies, Curaçao, Aruba, Margarita and Caracas. Then we spent a month with friends in Texas and Southern California where we were fortunate to be when the deserts were in bloom. In June we attended Rotary International in Denver. In November we spent two weeks in Puerto Rico and Florida, and we just got back from a visit to New York." . . . Ester and **Ken Johnson** are feeling better and fortunately have kept out of hospitals for the past year. . . . **Ben Lapp** has been enjoying his retirement with some travelling and visiting but was called back to work, temporarily, by his company. . . . Marion and **Vince Maconi** are planning a European trip this summer. . . . Helen and **Boots Malone** invite us to "cruise" to Florida this winter, where they will be sunbathing at Sarasota. . . . Virginia and **Hank Marion** will spend the winter in Tucson and would like to see any visiting classmates at Desert Club Apartments, 3805 East 5th St., Tucson, Ariz. . . . **"Big Ben" Neal** loudly rang out "Clang, Clang" on his card. . . . **B. Norton** designed a distinctive card declaring that she and **Charlie** were celebrating their 50th Christmas together. Congratulations to them. . . . **Mary Plummer Rice** has returned to Mill Valley, Calif., and says she has two extra jobs to keep her busy, Chairman of U.S.O. Clubs for the D.A.R. and Treasurer of the Mayflower Society out there. Credit to Mary for her interest and efforts in this noble work. . . . **Al Sampson**'s card was a beautiful and fine colored silk screen print made in Milan, Italy. On a pretty gold card **Bill Smith** wrote, "From the 'Bridgeway to the Stars.' I didn't know those cordials I served the night of Alumni Day would have such an effect. What do you think of Al Sampson's account of my little party?" Very good, we'll all say, Bill! . . . **Ray Stringfield** keeps busy: "We are having President Johnson out here for the M.I.T. Club's annual meeting in January. Guess we're getting pretty old. Our son Bob's oldest daughter made

us great-grandparents in October, and they've made me an Honorary Life Member of ACS and ASTM because I've been around so long. But they still send me lots of tires to inspect for defects and drag me in on patent rows, and with my two little corporations to keep me busy it's still a lot of fun. We may get East again next year, and if so, hope to see you." . . . In the spring Joan and **Bur Swain** are moving to 480 North May Street, Southern Pines, N.C. 28387. I suppose this means they are finally giving up on these uncomfortable northern winters, and I don't blame them. But we'll surely miss seeing them both up here. . . . It's wonderful to have all these cards from classmates and friends from all over our country and many thanks to you all for remembering us. **Ellen and Ellis Brewster**, '13, sent a unique and original card designed by their 23 grandchildren. . . . From Carmela and **Gustavo Gross U**, '50, a pretty greeting in Spanish—a reminder of the pleasant visit we had with them last February in Guayaquil, Ecuador. . . . And, from far-off Taiwan, a Chinese greeting from **Margaret and Gilbert Mar**, '52, son of our deceased classmate, Admiral **Pellian T. Mar**. Gilbert is vice-president and general manager of TAI TA Chemical Company, Ltd. in Taipei, Taiwan, a Mobil Oil division. He hopes to have his son, Sampson, enter M.I.T. in 1968, to be the third generation of the family at M.I.T. We all hope he makes it. . . . On December 10 Ruthie Place was married to Mr. Joseph Leo Hickey in Sacramento and will continue to live at 139 South Los Robles Avenue, Pasadena. Congratulations and all the best to Ruthie. . . . Remember to keep these dates so we can all get together again for big class dinners—April 21, Chemists Club, New York City and May 12, M.I.T. Faculty Club, Cambridge. Detailed notices later. Oh, yes! Pay your class dues and "help Azel." . . . **Henry Daley** wrote me with a clip from the *Philadelphia Evening Bulletin* on the death of **Greville Haslam** who died December 22. He was headmaster of the Episcopal Academy in Philadelphia from 1921 to his retirement in 1957 when he retired to live in West Edmeston, N.Y. The sympathy of our class goes to his family. All classmates who attended our 1950, 1955 and 50th Reunions at Coonamessett Inn on Cape Cod will mourn the passing of the owner and manager, Mrs. Edna L. Harris, who died January 6 at the

The importance of M.I.T. '16 to its President, Ralph A. Fletcher, is shown by his license plate, seen here at the Oyster Harbors Club, Osterville, at the 50th Reunion of the class last June.



age of 89. She was always congenial, generous and sincere in making our Reunions there so successful and enjoyable.—**Azel W. Mack**, Secretary, 100 Memorial Drive, Cambridge, Mass. 02142

'16

Dates, dates, dates—always dates to remember. But then some are more important to remember than others. And **Ralph Fletcher**, our good president and thinker-upper of things like the *Bucentaur* pageant of the 50th Reunion last June, says the most important one on your list should be June 9-11 for the 51st Reunion at Chatham Bars Inn and June 12 for Alumni Day in Cambridge. And by the way, as of early January we find the attendance at our 50th was one more than originally reported, 197 instead of 196, for **Duncan Owler** was there at the Commencement exercises and the luncheon, but somehow never got included on the final list. So the total was 197, with 107, not 106, classmates in attendance at the 50th, in Cambridge and/or in Osterville. Many memories of the 50th Reunion linger on. **Steve Brophy**, Reunion Committee Chairman, sends us this word he received from President Howard Johnson in December: "How good of you to send me the report of the 50th Anniversary Reunion of the class of 1916. I reviewed it all and much appreciated your sending it to me. There is no question in my mind but that the marvelous class of 1916 established all kinds of records, and the report is a fitting reminder to us all. It was a delight to see you at the Corporation meeting." Frequently mentioned in lively post-reunion conversations are the beautiful red blazers worn by all members of the class, a gift of several generous classmates. Steve points out that "the retail value of these blazers would range from \$35 to \$60, depending on where they were purchased. So giving them to the members of the class was a gift of importance, and contributed in a very real way to the success of the reunion." **Will Wylde** gives a "sidelight" of the reunion that he says we may find interesting. As he and Ann were leaving the Armory where the Alumni Night cocktail party was held, Ann "found herself walking alongside a chap who, though erect and spry, seemed somewhat older than the rest of us. He wore on his lapel one of those familiar name and class cards which we all used. So Ann asked him if he would mind if she saw what his class was. 'Not at all,' he said and turned the card so she could read his class numerals. It was the class of 1896. 'My goodness,' Ann said, '96, God bless you.' 'Thank you,' he replied, 'He already has.' . . . **Peb Stone** and your Secretary are continuing their efforts to identify each and every one of the 165 builders-of-the-future assembled merrily in the Reunion picture at Osterville. If you know of any one individual person in the picture, say one of the delightful ladies that attended a reunion for the first time, that you think might not be readily recalled by, shall we say **Peb Stone** or **Mary Barker**, please do send the information to **Peb Stone** (34-16)

85th St., Jackson Heights, N.Y. 11372, or your Secretary. Our goal is to have a 100% completely errorless list available at the 51st Reunion. And you will be interested in the clever way Peb has worked out the tabular listing! . . . Now, considering things back in Cambridge, we have a little booklet published by the Student Center Committee of the M.I.T. Institute Committee, September 1966, entitled *Where You Find Everything*. Inside you find the explanation: "Where you find everything is the Massachusetts Institute of Technology Student Center in the Julius Adams Stratton Building. Use this booklet as a guide to its services, recreation, restaurants, lounges, reading rooms, and activities." On page 5 we note an interesting '16 item: "Rita Welch Gruber Room, 4th floor, 5a, gift of **Rudolf E. Gruber**." And the 4th floor plan on page 14 shows just where this room is—a place to visit the next time you go to Cambridge! And Rudi is one of those who made possible the above-mentioned gift of red blazers at the Reunion.

Art Shuey tells of seeing the **Kem Deans** right in his own Shreveport, La. He writes: "Kem and Mrs. Dean spent Thanksgiving here, and his daughter and husband, Joe Hargrove, gave a big cocktail party for them on Friday night which I enjoyed very much." Further: "Kem said a friend of his was over in the Scottish Highlands for the grouse shooting and was with Mr. and Mrs. Ralph Fletcher." Art's Christmas letter started off this way: "The wish for a merry Christmas and a happy New Year is from Arthur only this time, for Mary Willis died in her sleep the night of March 22nd, but I know she would want this Christmas letter continued." And speaking further of family items he concluded with: "We had to take back 12 apartments, and Arthur, Jr., who lives with me, has done wonders in getting them repaired and rented. Young Henry Shuey is in his first year at Centenary and visits us most weekends, and his whole family gets here every once in a while. All of our friends have been exceedingly kind to me. Dinners, fishing and just plain sitting around with a drink in hand have made lonesomeness bearable."

. . . **Bill Barrett** was called to the Federal Grand Jury in New Haven in October. And then, you guessed it, he was appointed foreman of the Jury, with an 18-month term one day a month. He finds it very interesting, so far, he says. . . . **Joe Barker** says he and Mary have been doing mostly "resting" and church work since the 50th, "finding a new Rector for his historic Trinity Parish and then inducting and installing him in office. With the complexity of this parish and its endowment, this was not an easy task. We have had many congratulatory letters from '16ers and others about the 50th Reunion." (Joe was 50th Gift Chairman; Mary, a Women's Committee Chairman, Secretary.) "Our eldest grandson (also the grandson of L. S. Hall, M.I.T.'14) will graduate from Dartmouth next June with high honors and expects to enter M.I.T. for graduate work in engineering. Our son, Captain John P. Barker, U.S. Air Force, is in Vietnam and stationed about six miles from the Demilitarized Zone.

This gives us some worries." . . . In December **Arvin Page** in Winston-Salem sent us a news clipping from Pinehurst, N.C., about a '16 golfer we all know well. Who was it? I was his corporal, he was in my squad in freshman drill, and what he said to me once when "at rest!" Right, it is **Frank Ross** with a score of 74, 7th in a field of 386 "in the first 18 holes of a 36-hole qualifying test in the North and South Men's Senior Golf Tournament." Arvin comments: "In my book anyone who can come this close to shooting his age is a phenomenon." And Arvin has good news—he's better since the doctor operated on his arthritic knee, for now he can "walk without much trouble for a limited distance, up to one and a half miles per day. This minimum is gradually increasing and I hope by spring to get it up to four or five miles a day, enough to get around the golf course. I refuse to ride a cart!" This gives room for hope that he'll be at the 51st in June, for he says, "If I had felt this good last June I would have been with you boys!" We'll be looking for you again, Arvin! . . . We were glad to have a word from busy **Doug Robertson** around Christmas time. He wrote that the most interesting thing that has happened in his world recently was his company's annual Christmas party. Says: "This year it celebrated the 25th anniversary of its founding. I was presented with a book of letters of congratulations which I cherish very highly, including one from Ralph Fletcher, and a plaque bearing an engraving of one of my patents. We now have four plants in this country and one near London and a sales office in Switzerland which I visit twice a year." We might note that since 1941 Doug has been owner and manager of a company manufacturing web control equipment. His history reunion sheet says his greatest satisfaction came from designing devices and machines (he has invented some clever ones—ask him some time), and for extracurricular activities piloting planes meant the most to him. . . . **Bill Leach** reports that he and Helen are "still in a trance from the marvelous reunion." At Christmas time they were back in Texas. Having taken steps to sell their farm in Youngstown, N.Y., they had a very busy summer getting things cleaned up at the farm. They now say they have to go back next summer to finish up the job. . . . The Will Wyldes left home in Stamford, Vt., right after Christmas to spend the winter months in Arizona. They say that when they were out there on a short visit two years ago, they were much taken with a retirement community sponsored by the University of Arizona Foundation, called Green Valley, just south of Tucson. "This spring we decided to try it this winter instead of going to Anna Maria, Fla., as usual. I applied for reservation of an apartment for January, February and March. They promised to confirm it by mid-November. At the time of the Reunion we introduced ourselves to Virginia and **Joel Connolly** and told them of our plans. Joel said if he could help to let him know. When mid-November and even the first of December came and went and I got no news of my reservation from

the Green Valley people, I airmailed the story to Joel and asked him if he could be of any help. He got right on the job and within a very few days I had the confirmation I needed. So that's a 1916 classmate for you—just yell for help and they come running! We look forward to seeing Joel and Virginia as soon as we arrive." . . . **Jeff Gfroerer**, who with his wife Fannie and son Arthur was with us at the Oyster Harbors Club in June, had to undergo emergency surgery after the reunion. We are glad to report that he was making good progress at Christmas time. . . . **Ken Richmond** said a year ago he was "still working full-time—but weakening." "Full-time" means as executive vice-president of Abraham & Strauss in Brooklyn, a Division of Federated Department Stores, and that, as you can well imagine, is a busy, busy job. Over the years he has been mainly concerned with administrative and policy problems. Much of the time he has had over 5000 employees reporting to him. We understand his extracurricular activities have been associated with work and community life, but that his collection of ancient Greek coins was perhaps the best, outside of a museum. Ken, too, was one of the several classmates responsible for the gift of red blazers last June. . . . Kem Dean writes from Houston that Ada and he have done practically no travelling since the Reunion except to Shreveport, La., where they have a daughter and three grandchildren. Says: "The oldest is 17 and graduates June 10th from St. Andrews School in Middletown, Del., a lovely spot and a handsome group of buildings in Gothic style endowed and started I believe by the DuPont family. It is a real tough school, and the boys there get an excellent foundation for college. Don't know yet where this boy will go to college. The second grandson is 14 and a student at Sewanee Military Academy which he seems to enjoy very much. The youngest is 11 and goes to school in Shreveport." Kem mentions too the cocktail party in Shreveport at which his daughter and her husband "had about 30 older friends of ours—one was our classmate Art Shuey, and it was mighty nice to see him again."

One of our Christmas card makers, **Ed Hanford**, the only '16 resident of Indiana, says he has been busy as a two-headed woodpecker. He writes: "Within a month one of our engineers passed out with a heart attack, and another is laid up with a triple operation, so I am trying to handle four jobs which we have underway plus a number of jobs we are trying to get, ranging from a hydro job in Africa to a hospital in Indiana. Last week I had two flat tires and the cable in the garage door broke. How in the heck I ever got time to make my Christmas cards I don't know. I have managed to get out three oil paintings from sketches and photographs I made in Hawaii. In my spare time I am drafted by my daughter for advice on new math and French! This is Christmas Eve, and I just got home from work in time to take our tomcat to the hospital to be patched up after a big cat fight." Sure sounds like a good example of "busy!" . . . Another of our Christmas card makers, **Irv McDaniel** (with the aid of

talented wife Kay) of Newport Beach, Calif., literally spent months on their hand-painted sketchbook cards of The Ascension Window, Le Mans Cathedral in France. This could help in explaining why his reply to our news-gathering-questionnaire questions was expressed so economically, as follows: 1. Doing? "Nothing." 2. Where been? "Nowhere." 3. Who've seen? "Kay." 4. Children doing? "Nothing noteworthy." 5. Philosophy? But here Irv goes to town like this: "Lest we forget—we are a most fortunate class. We have lived in the most fascinating period of historic man. We have seen the development of the automobile, radio, television, camera, phonograph, sound devices, aircraft, solid-state electronics, and now—missiles. We have lived in the ages of steel, of chemistry, of electronics, and of nuclear physics. How the world has changed in 50 years. But with one exception—M.I.T.! M.I.T. has advanced to meet changing conditions but has not changed basically from the M.I.T. we knew and loved. To me it is symbolical of one man—Dr. Richard C. Maclaurin." Then: "We had a wonderful Christmas—the children must have found a Co-op catalogue because my gifts were most sophomoric. The weather is perfect. Kay just picked a large bouquet of roses. All the boats in the harbor are beautifully decorated this year and for five nights before Christmas they have an evening parade. This year it was superb and far exceeded past years. Cy and Gypsy dropped in on us for a couple of drinks. They spent Christmas in Glendale and were both wonderful." We hope to have sparkling letters from Irv and Kay as they scout the Asian countries including Thailand this spring. And speaking of Gyps and **Cy Guething**, Cy called us to report not only the visit with Irv and Kay but also meeting **Willard Brown** in the L.A. Airport, who was on a trip to maybe-it-was Santa Barbara. . . . **Stew Rowlett** reports that life is never boring in Clearwater, Fla. His hobby is portrait painting but roses come along as a close second. "Occasional bridge" may be a 3rd hobby, but it apparently had to step aside at Christmas time for Stew and Helen drove to Fort Lauderdale where their daughter's family of three girls and one boy ranging from 4 to 9 years and son-in-law, an ophthalmologist, live.

In the last issue we made a last-minute report of the death of **Obie Pyle** on December 4th. And now **Jim Evans** sends a report from **Harold Fuller** of Bryn Mawr who attended the memorial services representing the class of 1916. Harold writes: "When I attended the funeral I mentioned to several that I was representing O.B.'s class at Tech. Randy and others expressed appreciation. It is a nice funeral home and an Episcopal minister conducted the service which, as usual for that denomination, was simple and dignified and consisted mostly of passages from the Bible. The casket was draped with a flag. There were 30 to 40 people there, about two-thirds men, several from Honeywell where O.B. worked. Randy said his father did not suffer unduly with pain and that fortunately his mind was clear to the end, which is all merciful under the circum-

stances." Back in the old days Obie was what Irv McDaniel calls "such an outstanding undergraduate." Though retired he continued active on a part-time basis. We were always glad to welcome him at the Haven Beach seashore during our summer vacations, but last year, because of failing health, he missed. A clipping from a Philadelphia newspaper reads in part: "Oden B. Pyle, retired sales manager for the Honeywell Company, died Sunday in Rest Haven Convalescent Home, Eddenhelm, Pa. He was 72 and lived at 508 E. Valley Green Road, Flourtown. Mr. Pyle, a graduate of Massachusetts Institute of Technology, was the industrial manager of the Philadelphia branch of the Brown Instrument Company during the late 1940's. Later he became the Middle Atlantic sales manager for Honeywell. He was a member of the American Society of Metals and the Instrument Society of America. He is survived by four sons, Fletcher, Richard, Robert and Randolph." . . . We now regret to report the death of **Val (Percival P.) Gooding** on December 22nd in the Morton Plant Hospital in Clearwater, Fla. We have a preliminary report from Stew Rowlett who attended the memorial services on the 27th at the Moss Lakeside Chapel in Clearwater. Stew had reported a week earlier that Val had gone to the hospital with a heart condition. Stew writes: "We left our daughter's home in Ft. Lauderdale yesterday in order to be here for the services. We have just left the chapel and I enclose the 'In Remembrance' circular. The funeral was not very large for the Goodings have been here only a relatively short time. We used to play bridge with them every couple of weeks. We enjoyed them. Val had been a friend of mine while we were in the same company in 1923. He stayed to become head chemist of Strathmore Paper Company when he retired. Val was an exceptional person. He was calm and not noisy. I'll miss him." . . . And we regret to report the death of **Carl Holmberg** on December 15. A newspaper clipping gives the only information we have so far: "Services will be held today for Carl H. Holmberg, 72, of 6 Pleasant Street, Wakefield, a retired associate professor of civil engineering at Tufts University who died Thursday at the Melrose-Wakefield Hospital. He was graduated from Massachusetts Institute of Technology with a Bachelor of Science degree in 1916. In 1937 he received his Master of Science at M.I.T. Mr. Holmberg joined the faculty of Tufts in 1923 as an instructor, was named an assistant professor in 1926 and became associate professor in 1953. He retired in 1958."

The monthly class luncheons at the Chemists' Club, 52 East 41 St., N.Y.C., held on the Tuesday following the 1st Monday of each month, are commonly the source of much enlightenment. January saw five in attendance: **Walt Binger**, **Bob Burnap**, **Herb Mendelson**, **Peb Stone**, and **Harold Dodge**. Transportation problems into and out of New York City were partly settled. Worries about an airport take-over of the Great Swamp in New Jersey were abated. Hudson River overnight hydraulic power plants were put in their place. Herb Mendelson entranced his

listeners with a description of how, as a leg-weary snow-wading hunter, he found the perfect picture of peace and quiet responsibility in a farmhouse in New Brunswick, Canada, a contrast with the stirring busyness of New York City. Walt Binger, as Class Historian, told of progress being made to have available printed copies of the class history folder shown at the 50th Reunion. And he spoke delightedly of what **Vertrees Young** had written in answer to the question "What in your career gave you the greatest satisfaction?" The answer: "2. Planting over 150 million pine trees and helping to bring Louisiana from a condition of timber shortage to timber abundance." Thus the discussions go on at the luncheons. And we note that both Herb and Walt had a part in making the 50th red blazer gift possible. . . . We close with another reminder that the 51st Reunion comes on June 9-11 at the Chatham Bars Inn in Chatham. Just keep in touch. If you know of a '16er who is hospitalized or ill or just in need of cheery words, send the information to your Secretary or to Jim Evans (25-31 Fair Lawn Ave., Fair Lawn, N.J. 07410) of the '16 Good Cheer Division who has a goodly supply of Brophy-provided notification postals to be sent to those who would want to know. And keep sending in your bits of news, or philosophy, or even political views if you wish; just write a little but write often to any one of your class officers.—**Harold F. Dodge**, Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046

'17 50th CLASS REUNION

June 9, 10, 11, and 12

Al Moody, our class Vice-president from the beautiful state of Colorado, has written me on two occasions, and it is about time I reported again on his activities and quote from his letters. "While in Florida the winter of '66 we spent one weekend in Sarasota with a couple of M.I.T. 1920 men with whom I roomed my senior year. I had not seen them since and we had a lot to talk about. Your letter was forwarded to me from Florida. We went to Florida in July 1965 in order for me to do some special work for the Florida Gas Transmission Company, and we were there until August 1 of this year (1966). We had no intention of staying there permanently, as we like Colorado and Denver. The above address, 1200 Ivy Street, Denver, Colo. 80220, I am sure, will be a permanent one, although from time to time we may be away for a short period. Although 1917 men may be few and far apart in this area, I'll be glad to help you in any way I can. I am definitely planning on going to the 50th Reunion, but as of now I do not know of anyone else who will be going from this region. I had not heard about **Win McNeill**'s passing and was very sorry to hear it. He and I were both in option III in Course XV, so I knew him very well." . . . **Ross Pfohl** has retired and is now working from his Buffalo home on a part-time basis with his architectural firm of Pfohl, Roberts and Biggie. In addition to their general architectural work, Ross's

firm has specialized in educational buildings. Currently they are doing the new Federal building in Buffalo. The Pfohl's have three children and five grandchildren. One son is in the insurance business, one with Du Pont, and one daughter managing a husband. . . . **Dick Lyons**, our Vice-president from the great state of Texas, wrote as of last November, "The big event which we have experienced since my last contribution to the notes was a two-month trip to the Mediterranean area from October to December in 1965. We visited parts of Portugal, southern Spain, Majorca, southern France and most of Italy. Then we flew to Cairo, explored northern Egypt, then to Beirut to Jerusalem and Tel Aviv, exploring out from these cities. It certainly was a very rewarding trip. During 1966 Sammie and I have had to remain fairly close to home base. For me retirement has not become a reality; it would be difficult not to be occupied. My small business activity and added civic responsibilities result in a daily office schedule. The dynamic development of the Houston area has stimulated building programs and the expansion of certain health, hospital and education projects which I serve. One of our principal diversions has been increasing interest in baseball within the plush comfort of the Houston Astrodome. Our national league Astros did very well in the first half of the season before injuries and other handicaps took over. We look forward to a better season in '67. My business activity has included the acquisition of some oil and gas royalty interests in the Delaware basin of West Texas and Southeastern New Mexico, where numerous major gas fields are under development. Wells deeper than 20,000 feet are commonplace and \$1,500,000 per well in drilling expenditures is not unusual. Of course such expenditures are for the major companies while the small participants restrict their risks to royalty interests. Of some sentimental interest is the fact that, as a geologist 40 years ago, I was involved in the pioneering of the development of this same region when the depths of the wells then being drilled were from 1,000 feet to 4,000 feet. It is nice to be around in this period of such great dynamic changes. We expect to attend the 50th Reunion." . . . **Vincent Panettiere**, our cub reporter for Florida, writes as of last October, "Sorry to say that I do not have much to tell you except we had a meeting of the M.I.T. Club of Southwest Florida at Martines Restaurant on October 10, the first for the coming season. Dave Eberly, class of 49, who is vice-president of E.M.R. Corporation located in Sarasota, gave us a very instructive illustrated lecture on telemetry in Gemini rockets and showed us some of the component facts that go into this equipment. Emory L. Kemp, class of '16, who attended his 50th Reunion at Tech last June, gave us a very interesting account of the activities that took place. I was very sorry to learn of the passing of Win McNeill, who was a very fine person and a very likeable and friendly one. It was just a couple of years ago that he spent several months in Sarasota with his wife, and we had many interesting

visits and also went deep-sea fishing a couple of times. As for me, I am just taking life easy, taking a trip around Florida once in awhile."

Justin Basch, our Vice-president from Philadelphia, also writes as of October, "Sorry I cannot help you out. Went to an M.I.T. Philie meeting, no '17ers there but me. **Walter Beadle** was listed, but did not show. I have done nothing but retirement routine since I saw you in September at Cambridge. I worked most of the set of cards you sent me in connection with the list for contributions for the 50th and found the majority very inactive with the whole list untainted with any newsworthy item." . . . **Ray Blanchard**, who suffered a shock on the occasion of the opening of the new wing of the Melrose-Wakefield Hospital two years ago, is now presiding at monthly meetings of two Melrose banks. He attended the unveiling of a bronze plaque placed in his honor in the hospital which reads, "Raymond H. Blanchard, President 1960 to 1965. His visionary leadership was a major factor in making this wing a reality." The \$2,700,000 wing has been in operation since the opening over a year ago and has converted the hospital from a below-critical-size struggling activity to a viable modern hospital covering an enlarged area effectively. The word is that in the early stages only one man believed the goal attainable, one Ray Blanchard. . . . **Frank Peacock**, another cub reporter from the Chicago area, writes, "Your letter about Win's passing was indeed a shock to me. Then I read in the class notes about **Dean Parker**'s death. Dean was a

Stanley Lane, '17, received the award of Doctor of Laws, December 7, at the Gordon College and Divinity School, Wenham, Mass. (See February notes.)



fraternity brother of mine, and when we see our friends going it sure brings us up short. I am enclosing some newspaper clippings about **Robert Mulliken**, which may have missed some of the Eastern papers. [Will cover at a later date.] I am definitely planning on making the 50th. Had hoped I would be in the East for the 49th, but did not make it. Have been officially retired for the past three years, May 1963, but am a consultant for my old firm, so that has taken up nearly half my time. I am also doing other consulting work which keeps me busy. The rest of the time is spent being a bum, which is sort of fun. Seems to me someone said the Treasury [imagine you mean Uncle Sam] had had a spell of inflation; don't know where to send the enclosed, so will ask you to do the honor." I am always glad to please you Frank on such matters, and your check has been forwarded to **Lucius T. Hill**, Treasurer, 47 Sargent Road, Brookline, Mass. . . . **James Charles Flaherty** comments on an article which I forwarded him bearing on the present grotesque but functional architecture of this decade, "a page of pre-conceived slums which he enclosed could very well find a place in a high-class latrine if there is indeed such a place." If there are any farmers in the class who need to upgrade their Sears Roebuck, I am sure Jim will oblige as my last contact goes back to World War I. . . . Just in case Doris and **Joe Littlefield**'s Christmas letter did not reach you, would quote as follows: "As we bask in the sun after a swim in our pool, we cannot help wondering what our first Christmas in Florida will be like. We will miss our many friends around Connecticut and the Christmas carols, the snap in the air, the snow on the ground and the fire on the hearth. Yet we are intrigued by the differences we see; flowers and green everywhere and elaborate outside decorations being prepared by our neighbors. We shall continue our custom of candles in the windows, but our Christmas tree will stand in the patio by the pool. Doris has been busy in many ways besides the house, including Junior League meetings and tennis. Melissa and Joshua bicycle to school only four blocks away. They are active in many projects and with new friends. Bill has been enjoying himself making things for the house and working in the garden. Joe is as busy as ever working on his book and on his current project of a small sunny patio outside our bedroom. We are all enjoying good health. We are slowly getting settled in our temporary home. It has taken all fall to build a new bedroom and to put the grounds in shape. Now we are be-

PLAN AHEAD

for your

CLASS REUNION!!

Mark these dates down

on your calendar

June 9 10 11

AND

Alumni Day June 12

- Renew old friendships
- Relax and enjoy a wonderful week-end
- Then come back to the campus and witness the many changes, see, meet and talk with the faculty and listen to the dynamic seminars on Alumni Day

MAKE YOUR RESERVATIONS NOW

. . . Full details are on the way



Five of the '17 New York group are shown here at the class luncheon, Chemists Club, December 8.

ginning to plan what we shall build next year on our lot in Snapper Creek Lakes." . . . Esther and **Ted Haviland** were good enough to include a note in their Christmas greetings, "Ted nursed his grass and flowers along, feeling instead of seeing. We went to Antigua in March, I went to Hawaii in July, we were at our cottage at the shore in New London in September and at the Elbow Beach Club in Bermuda in November for swimming. Home in Ridgewood, N.J., until March, then down to The Anchorage in Antigua again in March." It is good to hear of you, Ted, and we will be expecting you and Esther at the 50th.

Referring to **Al Lunn**'s letter of December 13th and it's listing of the class, it shows 380 whereas my mailing list shows 358, so I see that our widows, God bless them, have been added, or at least some of them. Mrs. William C. Mehaffey, Lydia, writes, "Just got one youngest and her family off to Dikarta for two years, I may take a slow boat out later. Have you been on the President Lines cargo ships?" We can highly recommend the *Jungle Run* of the President Lines out of San Francisco. . . . It is with deep feeling that I have word from another widow, namely Mrs. **Allison Williams**, Henritte, on the passing of Bill on August 27, 1966. Seems he had a bad summer and entered the hospital on June 27 in Vicksburg, Miss. He had a difficult time while in the hospital, but remained alert until the last, dying of heart failure. Bill was one of the very first freshmen I met. We roomed together at Ma Fairbanks at 172 Huntington Ave., top floor, and he gave me a very liberal education as a southern gentleman. At that time he was the son of the senior senator from Mississippi. . . . Jeanette and **Stan Dunning** spent a night with us at the beginning of the new year and he placed the order, with a Paterson, N.J., outfitters which will make the '17ers the best dressed 50th Reunioners! Whether you are going to be able to attend your 50th or not, all '17ers should have their order in before the March 1 deadline! . . . '17ers on the march—**Carl E. Geiger, Jr.**, Buck Creek Road, RFD #2, Floyds Knob, Ind. 47119; **Gale D. Goepfert**, 2913 Buckley Ave., Lakeworth, Fla. 33460; **S. Phillips Houghton**, Calle Angulo 1860-3 Guadalajara, Jalisco, Mexico, 6MX; **Samuel Lewiton**, 40 Stetson St., Brookline, Mass.

02146; **Howard G. Mann**, 6 Bayhaven Drive, Longport, N.J. 08403; Dr. **Robert S. Mulliken**, Florida State University, Tallahassee, Fla., 32302; Dr. **Edward Sampson**, 102 Lafayette Road, Princeton, N.J. 08540. . . . The regular monthly luncheons of the New York group continue and the picture herewith shows those who enjoyed a good lunch at the December luncheon. Of course the M.C. is the photographer. . . . In closing let me quote from Harold Dodge's notes, "and in the meantime, help keep this little old column full and interesting by writing a little, but writing often to anyone of your class officers, including perhaps a snapshot of interest."—**C. Dix Proctor**, Secretary, P.O. Box 336, Lincoln Park, N.J. 07035; **Stanley C. Dunning**, Assistant Secretary, 1572 Massachusetts Avenue, Cambridge, Mass. 02138

'18

Somehow we all become gentler and more sensitive folk at Christmas time, an occasion just past as these notes are being assembled. Beyond the window pane a heavy snowfall is growing with an almost perverse beauty while I go over my cards. Here's one from **Al Murray** in the warm and friendly spirit of the holiday season.

. . . Here's one from **Arthur Pope**, way up in Waukesha, Wis. To his surprise, and mine too, he ends up the year with the discovery that his local library has several of my books. The one he took out was *Living A Happy Life*, which I hope says something worthwhile in a way which reveals the importance of really living a happy life. Socrates said that the unexamined life is not worth living. I agree with Condert, who says that the unlived life isn't worth examining! . . . Here's a card from **Sax Fletcher**, artfully decorated with 13 heads of his grandchildren in a numbered sequence which apparently corresponds with their seniority. An unadorned number 14 may, or may not, be significant of things to come! . . . This card is from **Jim Flint** who adds to his greeting, "We expect to leave in February for a trip to the South Pacific, New Zealand, Australia and the Orient. We had expected to go this year (i.e. 1966) but had to postpone exploring the great curve of the earth because my wife was ill. Last summer we did have a marvelous four months at our place in Montana where I was beaverishly busy with some ranch projects." . . . **Fred Philbrick** says, "Due to one of the hurricanes we had another case of high water at the house we own on the beach front. Fortunately it was not as bad as last year, despite which the first floor was submerged enough to float a goldfish. It will be a relief to get the place sold. Moral: never lend money to help a friend unless you are willing to lose some lettuce. Polonius was a wise old man. Anyway, our banana tree is beginning to bear and the orange tree is loaded. I enjoy picking my own fruit." . . . Here is a card from **Johnny Clark**, but it brings no personal word from his ivory tower at the Mississippi State University.

. . . Our still unclaimed blessing, **Gretchen Abigail Palmer**, says she is, "planning to come East in June 1968. It will probably be my last trip to the old, so familiar place where college ties were fastened." . . . The card, which gave this aging local kindergarten Santa Claus his biggest chuckle, came from one of the few classmates who has made a cool million in coin of the realm. Last summer he built an enormous barn, the better to house an augmented herd of what I take to be Ayrshire cattle, a dairy breed from Scotland. This surely somewhat reduced his liquid assets. Reasoning "after, therefore because," I suspect it was with unquestioning faith that he sent me a Christmas card wholly innocent of any postage. With equal unquestioning of a handsome income tax, Uncle Sam delivered the card in all its naked innocence. Give ear, all ye who have a hankering for a hint of human warmth in government agencies. The Alumni Office informs me that **Ernest Grunsfeld** is at 157 Boulevard St., Germain, Paris 6, France. Those couriers whom "neither snow nor rain nor heat nor gloom of night deter from the swift completion of their appointed rounds" have been entrusted with a plea from a word from him.—**F. Alexander Magoun**, Secretary, Jaffrey, New Hampshire 03452

'19

Karl Rodgers, our travelling classmate, wrote as follows: "Allegra and I have deserted our Airstream Travel Trailer for the time being and are spending a year in Europe. We thought it wise to renew our acquaintances here of two years ago before we were forgotten. Since September 1 we have covered about 6000 miles in our little Karmann-Ghia in Germany, Austria, Switzerland, France and Spain. As of December 1 we shall be at the San Carlos Apartamientor, Benalmadera, Spain, near Torremolinos. The Hotel, Siroco, is adjacent and we hope some of our friends will drop in to see us. We hope our children will be able to enjoy our Cape Cod house for a long time before we finally settle down there." . . .

George F. Magraw has just retired from the Massachusetts Department of Correction, where he has been an executive for 30 years, the last ten years as Supervisor of Education. He has two sons and three grandchildren. . . . **George A. Irwin** served in both the First World War and the Second, when he was commissioned colonel. He retired from the automobile business in 1953 and has been living in Delray Beach, Fla., since 1956. He plays golf three times a week, and chess at least once. . . . **Locke James** is now vice-president of the State University of New York Agricultural and Technical College at Farmingdale, N.Y. . . . **Robert MacMullin** writes that "life is too exciting to retire" and that he has quite an operation going in Japan and Korea. "Our three children and nine grandchildren are doing fine, and Olive and I wish all the '19ers a happy New Year. I'm planning to attend the 50th."

We have received notice, but no particulars, of the deaths of the following members of the class: **Daniel H. Brown**, of Lebanon, N.H., on June 15, 1962; **Maurice H. Role**, Hyde Park, Mass., on January 26, 1965; **Harold K. Ireland**, Greenfield, Mass., November 14, 1965; **Austin J. O'Connor**, Milton, Mass., on December 25, 1965. New addresses are: **Carl G. Polson**, R.F.D. Phinneys Lane, Centerville, Mass. 02632 and **Louis A. Brown, Jr.**, P.O. Box 265, Beverly Hills, Calif. 90213.—**Eugene R. Smoley**, Secretary, 30 School Lane, Scarsdale, N.Y. 10583 (till April 1—1111 Casuarina Rd., Delray Beach, Fla., 33444, Tel. 305-278-4537.)

'20

In addition to those mentioned in the February notes, much appreciated Christmas and New Year messages were received from Winnie and **Frank Badger** of Hollywood, Fla., Catherine and **George Dandrow**, **Bob Patterson**, Dottie and **Stan Reynolds**, Denise and **K. B. White** from their castle where the Oise River meets the Seine, and Vera and **Homer Howes** who say that they are looking forward to the 50th Reunion. The Howes appear as proud of the modernization and improvement program of their home city, St. Louis, as we Bostonians are of the "new Boston." We wouldn't be surprised if Florida turned out to be the state in which more of our classmates reside, at least in the winter months, than any other. Add to the long list the names of **Dick Gee**, 6711 N.W. 15th Court, Hollywood, and **Lancy Snow**, 279 Talbot St., North Port, Charlotte. Why don't all of you '20 Floridians get together and organize a class reunion down there? It might even provide some of us shivering northerners an excuse to come on down. . . . Professor **Senichi Fujimura** is in Yokohama, address Shirahata, Kanagawa, Kw. . . . Doctor **William S. Johnson** is in Philadelphia, 10895 Crestmont Ave. . . . I just learned that **Albert B. Greene** died on November 9 last. When last heard from he was in Washington, D.C. We were sorry to hear of his passing. Can anyone in the class give us further information about him?—**Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, Mass. 01890

'21

Saludos, amigos! We're here, south of the border, down Mexico way! And we're celebrating the 50th anniversary of the establishment of the class of '21, in conjunction with the 19th annual Fiesta of the M.I.T. Club of Mexico City. If you and your wife are shivering up there in the cold and you can still make it, come on down! At this date you had better phone or wire the Fiesta Chairman, I. M. Clark, '61, at Reforma 116—804, Mexico 6, D.F., where the telephone is

46-57-74. Then, hop a plane and get down here where the fun is—fast. If you can't join the happy '21 group which, at this early January writing comprises 25 couples, we'll try to tell you all that happened in the June issue of the Review. In the meanwhile, please send us the questionnaire you received before our 45th Reunion, so we can continue the very considerable work involved in preparing the '21 Class Directory. A new batch of questionnaires has come in and we are most appreciative. If yours was among them, accept our thanks and ignore this appeal. If it wasn't, please give us a most pleasant surprise on our return from Mexico City by mailing it to the Brielle address below right away. Ask for a blank form if you can't find the old one. . . . Received just too late for last month's notes is the following fine letter from Colonel **Asher Z. Cohen**, U.S.A. (retired), who lives at Apt. 1A, 3505 Langrehr Rd., Baltimore, Md. 21207. Asher says: "Dear Cac, I hope this letter will make up for my past derelictions. I cannot fully express my regrets in not being able to attend our 45th Reunion. I had looked forward with keen anticipation to being there and renewing friendships with classmates, many of whom I have not seen in 20 years. **George Schnitzler** has written and told of the unusually fine time I missed. I am now a member of the retired alumni. My plans for the future are rather indefinite at this time. On the occasion of my retirement, I was pleasantly and unexpectedly surprised with a dinner attended by many friends and co-workers. I was awarded the Army Achievement Certificate, a number of scrolls and a variety of gifts. Despite the magnitude of the affair, there was never a hint that I was to be honored in this manner. I was particularly sorry that I could not witness the presentation of the gift to you as a token of appreciation by our class. It was richly deserved. I fully appreciate the work entailed from personal experience. May I add that I will support you by contributing to our Class Gift to the Alumni Fund. I know this is close to your heart. Please accept sincerest personal regards and best wishes." Our sincere thanks for those kind words! For the last 16 years Asher has supervised the development of weapons systems at Edgewood Arsenal. During the prior six years, including the period of World War II, his military service in the Ordnance Corps was recognized with the award of the Legion of Merit. As a civilian he also received the Sustained Superior Performance Award from the Department of the Army. Clara and Asher have two married daughters and five grandchildren. . . . **Adolph H. Aronson** gives a new home address at 43 High Hollow Rd., Roslyn Heights, N.Y. 11577, but didn't return his questionnaire to tell us whether or not he has retired from the presidency of Arco Fabrics Company, Inc., of Great Neck, N.Y. How about it, Arry? . . . Also, in the absence of his questionnaire, we are not sure whether **Irving D. Marshall** has retired and await his advice. Irv says his mail should now be addressed to R.F.D. Rt. 1, Box 15, Iowa City, Ia. 52240.

Donald G. Morse, 44 Lowell Rd., Wellesley Hills, Ma. 02181, is a partner in Jas. F. Morse and Company, manufacturers of tallow hardeners with a plant in Roxbury. He is a director of the Roxbury Institute for Savings and the Roxbury Home for Aged Women. Kim and Don have a single son, Douglas, a married son, Richard, and two grandsons. A friendly note from Kim in reference to our 45th Reunion says: "It was good fun!" . . . **Harold A. Greenwald** also added a welcomed note to his questionnaire saying: "Before retirement last year I had many good intentions of sending you a bit of news but always seemed to be too busy—sorry. Your class notes are always interesting and are the best!" Our thanks to Hal and Thelma who now make their home at 1959 Mandeville Cyn. Rd., Los Angeles, Ca. 90049. Hal retired from the Airesearch Division of the Garrett Corporation in 1965 as project engineer in the research, development and design of new turbomachines for aircraft and space application and is continuing his practice of engineering as a consultant. He has 85 patents. A member of the Society of Automotive Engineers, he is also active in the Beverly Hills Men's Club and the Greater Los Angeles Zoo Association—in between a number of pleasure trips to Europe, Mexico and Western Canada. The Greenwalds have a married daughter, Joan, who attended the University of California at Berkeley. . . . Another welcomed questionnaire came from **George B. Wetherbee**, 2645 Covington Pl., Birmingham, Mi. 48010. George retired in 1944 from the shipbuilding division of Bethlehem Steel Company, Quincy, and is now an independent financial trustee. He is a member of the Society of Naval Architects and Marine Engineers and a director of the Evergreen Association of Detroit. Margaret and George have a married son, Paul, who attended Yale and Columbia, a married daughter, Katharine, a Wellesley graduate, and seven grandchildren. . . . **Frederick N. Morgan** reports a new home address at 23 Charles St., Auburndale, Ma. 02166, but failed to include his questionnaire. He is engaged in design and construction duties with the General Services Division of the U.S. Government in Boston. . . . **Clifton B. Morse** writes that he has retired from Wilhoites, Inc., Los Angeles, and makes his home at 241 Loma Dr., Salinas, Ca. 93901, where his chief hobby is golf. He and Elizabeth have a married daughter, Barbara Jean, a Stanford alumna, and four grandchildren. . . . **Edward W. Noyes, Sr.**, and Kathryn have made their seasonal trip from their home in Pennsylvania to their winter abode at 1410 S.E. 7th Ave., Pompano Beach, Fla. 33060. For the statisticians to ponder, they have four married children, each child has four children and there are eight grandsons and eight granddaughters. Ed retired in 1960 as head of the New York office of Chicago Pneumatic Tool Company. . . . **Munnie Hawes** tells us he had a Christmas card from **Frank E. Huggins, Jr.**, his buddy in the "4H Club" of Course X and his best man 44 years ago. Squeeze lives on Mather Lane, Chagrin Falls, Oh. 44022. Alex and Munnie's youngest,

George, is in the air Marine Corps, training as a pilot.

Once more we have reached that most exhilarating time of year when your heartwarming message of news and good cheer has served as the top reward you can bestow for service in your behalf. It is always a source of tremendous pleasure to Maxine and your Secretary to hear from you at any time, and we are particularly thrilled to get your friendly words of encouragement during the annual period when the members of all closely-knit families renew their bonds of love and friendship. We both acknowledge and sincerely thank you for thinking of us. Among the splendid tributes and greetings are those from Anne and Wally Adams, Pat and Al Addicks, Olive and Ollie Bardes, Elizabeth and John Barrieger, Ednah Blanchard, Mary and Buck Buckner, Ethel Burckett, Jack Cannon, '24, Marion and George Chutter, Mary Louise and Rich Clark, Edna and Phil Coffin, Sarita and Gonzalo Docal, '44, Maida and Ed Dubé, Helen and Ed Farrand, Catharine and Harry Field, Eddie and George Gokey, Betty and Mory Goodhart, '35, Doris and Bob Haskel, Phil Hatch, Alex and Munnie Hawes, Betty and Sumner Hayward, Betty and Dug Jackson, Ruth and Irv Jakobson, Marge and Jack Kendall, Laurie and Chick Kurth, Moose LeFevre, Fred Lehmann, '51, Emma and Al Lloyd, Conchita Lobdell, Milicent and Joe Maxfield, '10, Helen and Bob Miller, Helen Mosher, Kay and Phil Nelles, Muriel and George Owens, Marty and Bill Ready, Graciela and Helier Rodríguez, Helen and Ray St. Laurent, Anne and George Schnitzler, Madeline and Rufe Shaw, Edith and Harry Thomas, '25, Helen and Lem Tremaine, '23, Louise Tucker, Maria Helena and Vivi Valdés, Ruth and Ralph Wetsten, India and Dave Woodbury. We shall endeavor to summarize the much-appreciated news items in this and succeeding sets of notes on the activities of the Class of '21. . . . The note from Catharine and Harry Field, penned by Catharine, says: "We were so sorry to have had to miss the 45th Reunion. For several years we had looked forward to it and planned to go. It was my 45th from Smith also. But Harry was not well enough to make the trip. We are moving about the first of February, 1967, into an apartment in a lovely new retirement home. Our new address will then be: 'Arcadia,' Apt. 1137, 1434 Punahoa St., Honolulu, Hi. 96822. Our seven grandchildren are all in school here now, with the exception of Linda who is just two and a half. She is a blue-eyed, curly-haired blonde and quite a charmer. They grow up much too quickly. When are you two coming out for a visit? With aloha from us both." Our greetings to a grand couple who really were missed last June. Although retired from the Hawaiian Electric Company, of which he was vice-president and general manager, Harry is still active as a director of the Molokai Electric Company, and in Rotary International as a former district governor and president of the Honolulu Club. He is also a director and past president of the Engineering Association of Hawaii, a director of the Chamber of Commerce, vice-presi-

dent of the Y.M.C.A., trustee of the Central Union Congregational Church and a member of the Electrical Examining Board of the City and County of Honolulu. He has served M.I.T. for 25 years as an Honorary Secretary. The Field's two married sons are associated in business and industry in Honolulu. On his recent trip to Europe and the Orient, **Saul Silverstein** returned via Hawaii where he met with Catharine and Harry and brought them up to date on our 45th Reunion and other class affairs. We know we speak for the entire class in sending hearty greetings to the Field family. . . . Ruth and **Ralph Wetsten** wrote, in part: "Dear Cac and Maxine, We were disappointed in not being able to make the reunion, and we missed seeing you. We enjoyed reading the details of the reunion in the November Review and were very pleased to read of your well-deserved reward for wonderful service as Secretary. Thank you for forwarding the **Rufe Shaw**'s Christmas card. We have sent them our new home address at 155 West 68th St., New York, N.Y. 10023." . . . Anne and **Wally Adams** sent greetings with a note saying: "Thanks for forwarding Ray's reminder about the Mexico City trip. We are writing to tell him to include us in the plans. From Cambridge last June we went to the far end of Cape Breton Island, returning to Middletown, Ohio, about the first of July. Boy Scouts, Safety Council and golf have kept me busy since then." Wally has since phoned us to inquire about arrangements for the class trip to Mexico and to assure us he and Anne will be on hand for the festivities. Since his retirement in 1964 as specification engineer of Armco Steel Corporation, he has been a consultant. He is vice-president of the executive board of the Miami Council, Boy Scouts of America, and the holder of its highest award, the Silver Beaver. He is chairman of the Highway Commission, director of the Safety Council and a member of the Ohio Safety Commission and the Ohio-Indiana-Kentucky Transportation Study Committee. His memberships include the American Society of Civil Engineers, the National Society of Professional Engineers and the Ohio Society of Professional Engineers, of which he is vice-president. His spare time is devoted to photography, fishing and golf. He and Anne have two married sons and a married daughter. The eldest of the twelve grandchildren is in high school. . . . It is with difficulty that we endeavor to do justice to an account of the latest journey around the world in 61 days accomplished by the chief traveler of the class, Saul Silverstein. It was his 22nd since 1952 and Rigi's twelfth to accompany him during the same period. Returning home last November, Saul summarized it thus: "My fourth trip completely around the world since 1961—this time to 27 cities in 11 countries, 7 of them within the communist bloc—with 46 working days." Saul notes that **Joe Wenick**'s son, Martin, was the U.S. diplomat in Czechoslovakia (he is second secretary and vice-consul of the American Embassy in Prague) who interviewed Cambridge travel agent Vladimir Kazan-Komarek when he was detained by the local constabulary.

We pause between sentences for word of Rigi and Saul's later safari—not now known to us—probably already under way right now. They come so fast that we just about get around to referring to one before a subsequent trip is practically ended. The multitudinous successful operations of Rogers Corporation are certainly being emblazoned before a substantial portion of the world's potential users, who seem to be most receptive to their unique values. But it's a two-way channel, since Saul has been a devout collector of geologic samples, coins and stamps for his family and friends. We are particularly delighted to be included in the group. Many thanks, Rigi and Saul! . . . Writing from his new home at 7910 Birnam Wood Dr., McLean, Va. 22101, Class Photohistorian **Robert F. Miller** has sent us his complete set of color slides, taken at the Reunion and Alumni Day last June. If you have additional slides you would like to contribute to the class collection, please mail them to your Secretary and we will gladly incorporate them into the files. Bob says he has also made color enlargements of the pictures and has sent them to various of those present. He and Helen are planning to join the '21 group for the interim reunion in Mexico this month.

As we prepare these notes, we are happy to report that Class Agent **Edouard N. Dubé** has successfully undergone surgery and is resting as comfortably as possible under such conditions. Helen and **Ray St. Laurent** and Maxine and your Secretary have been in telephonic communication with Maida Dubé. Despite the happy addition of two grandchildren, the last year also brought the Dubé family some unwelcomed events, and we hope these latter are the last for all time to come. Maida herself is still taking it easy from illness early last year and the shock of her brother's passing at year end. Son-in-law Paul McDonald was involved in a bad automobile accident at Christmas time and will have a long recovery period. Ed said that the use of a seat belt was effective in preventing a complete catastrophe, which encourages us to renew our continual exhortation to the members of the class to make certain they always insure they and all other passengers fasten seat belts before driving or riding in an automobile anywhere anytime. For all of us, get well quickly, Ed! . . . Augusta and **Franklin T. Flaherty** make their home on Lincoln Rd. and receive mail via Box 12, Lincoln, Ma. 01773. Those who had the pleasure of talking with them at the Reunion and Alumni Day know that they have five children and 14 grandchildren. Frank retired in 1960 as patent counsel for DuPont in Wilmington, Del., and is continuing this work as a private consultant. He has written five volumes on patents. He has been admitted to practice before the U.S. Court of Appeals, the District Court and the U.S. Patent Bar, all of Washington, D.C., as well as the Canadian Patent Bar. . . . Dr. **Williston Wirt**, who retired in 1963 from the Congregational ministry, lives at 694 Priscilla Way, Claremont, Ca. 91711. Genevieve and he have two sons. Eliot has three children and lives in San José; Will, Jr., is single and a

teacher of biology in Kodiak High School, Alaska. Will, a retired lieutenant colonel, Chaplain Corps, U.S.A., which he served during World War II, was also western regional chaplain of the Civil Air Patrol. He has been awarded the Silver Beaver of the Boy Scouts of America and continues active in the Claremont University Club. . . . We urgently request the following seven members of the class to return that questionnaire form in support of the addresses below and to confirm their activities for the Class Directory. . . . **Harold K. Moritz**, 4500 N.E. 50th St., Seattle, Wa. 98105, is professor of hydraulics at the University of Washington in Seattle. . . . **John T. Rule**, M.I.T. Professor of Engineering Graphics Emeritus and former Dean of Students at the Institute, has retired to a new home at 463 Camino Manzano, Santa Fe, N.M. 87501. . . . Major General **Stanley L. Scott** has a changed home address at 831 Herbert Springs Rd., Alexandria, Va. 22308. . . . **Robert P. Stebbins** reports his home address as 3309 Brockton Ave., Riverside, Ca. 92501, where he is in the commercial department of the Warren-Anderson Company. . . . **Howard B. Tuthill** is president of the Oliver Machinery Company, 445 6th St., N.W., Grand Rapids, Mi. 49502. Recently we had occasion to refer to the textbook by Lansburgh and Spriegel on industrial management and discovered a whole section devoted to the organization of the Oliver Machinery Company. Reference is made to ". . . the president, a graduate engineer . . ." and to ". . . the high degree of cooperation between the officers of the company . . ." as well as to ". . . the success of its activities. . . ." Quite a recommendation. . . . Dr. **Manuel Sandoval Vallarta** is a member of the Comision Nacional de Energia Nuclear, Insurgentes Sur 1079, Mexico 18, D.F., Mexico. He and Maria Luisa are planning to attend the Fiesta of the M.I.T. Club of Mexico City this month. We are indebted to him for a most welcomed letter, with suggestions for side trips of interest out of Mexico City. . . . **Clarence S. Wentworth** has retired as commercial vice-president of the Worthington Corporation, Cleveland, and advises he has a new home at 5941 S.W. 1st Ct., Cape Coral, Fl. 33904. . . . The last-minute listing, prepared by Ray St. Laurent as these notes go to press, has the following as prospective attenders at this month's '21 interim reunion in Mexico City: Anne and Wally Adams, Pat and Al Addicks, Olive and Ollie Bardes, Billie and Tom Bartram, Helen and Mich Bawden, Maxine and Cac Clarke, Vina and Ray Cooper, Helen and Ed Farrand, Sarah and Harry Goodman, Alex and Munnie Hawes, Betty and Dug Jackson, Ruth and Irv Jakobson, Anne and Mel Jenney, Dottie and Wayne Keith (guests of the Bawdens), Helen and Bob Miller, Kim and Don Morse, Kay and Phil Nelles, Muriel and George Owens, Marty and Bill Ready, Helen and Ray St. Laurent, Anne and George Schnitzler, Lovina and Ted Steffian, Maria Helena an Vivi Valdés, Maria Luisa and Manuel Vallarta, Winifred and Woodie Wood. There's still room for you and your wife, if you can make it. Hope to see you there!—

Carole A. Clarke, Secretary, 608 Union Lane, Brielle, N.J.; **Edwin T. Steffian**, Assistant Secretary, c/o Edwin T. Steffian and Associates, Inc., 19 Temple Place, Boston, Mass. 02111

'22 CLASS REUNION

June 8, 9, 10, and 11

Greetings from the usual sunny Buffalo, and that's not kidding. Here we are getting along in January, the sun is shining, the thermometer reads 38 degrees and we wonder where the winter went. Your Secretary is introducing Vice President Humphrey at the Buffalo Club Centennial and is then flying to Florida to call on a few classmates. All this to increase the attendance at our 45th Reunion this coming June 8 to 12 at the Wianno Club on the Cape. Please make a note of these dates right away! . . . **Chuck Brokaw** has written of their Denver weather of 60 inches of snow in the mountains while playing golf in 60 degree weather in town. His girls of 16 and Chuck 13 are all members of their Club's ski team. Young Chuck also takes after his father on the golf course, having had an 84 at the Denver Country Club last summer. He tells of getting in 86 rounds of golf in '66 and is planning on several at our Reunion. . . . **Marion S. Dimmock** has sent greetings from New Britain, Conn., and more information about his experience in building the towers and domes of the Y.M.C.A. in Jerusalem. He also felt that the French want to change the name of the Rock of Gibraltar to DeGaulle Stone. We have to admit that Dimmy is right on the gall. . . . **Oscar Horovitz** sent in a clipping from the *Seattle Times* picturing **Horace McCurdy** with his new \$100 book entitled *Marine History of the Pacific Northwest 1896-1965*. This book brings the previous history of Lewis and Dryden up to date. Horace engaged author Gordon Newell through the Seattle Historical Society to edit the history, and a review board made up of 19 marine historians throughout the nation was formed to check all material. The research and writing have taken four years with sales expected to be over 1200 copies. All royalties will go to the Seattle Historical Society. . . . Professor **Joseph H. Keenan**, Head of Mechanical Engineering, M.I.T., has been elected to honorary membership of the American Society of Mechanical Engineers during their 1966 winter annual meeting. Congratulations to Professor Keenan for receiving the Society's most coveted award. Among the changes of address are those of: **Robert D. Hoffman**, New York, N.Y.; **Thomas B. Stewart, Jr.**, Belmont, Calif.; **Arthur L. Pitman**, Alexandria, Va.; **Charles H. Mullenberg, Jr.**, Wyomissing, Pa.; **Carl J. Lundborg**, Hamilton, Mont.; **William H. L. James**, Anaheim, Calif.; Professor **Warren E. Howland**, Lafayette, Ind. . . . May your spring be springy and your life all sunny and your plans all perfectly pointed toward our June Reunion. See you there!—**Whitworth Ferguson**, Secretary, 333 Ellicott Street, Buffalo, N.Y. 14203; **Oscar Horovitz**, Assistant Secretary, 33 Island Street, Boston, Mass. 02119

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"A spectacular leap forward for the pulp and paper industry is in the making. Billions of dollars in business is at stake. For paper fabrics of all kinds—non-wovens, disposables for homes, hotels, motels, hospitals and the military, and similar paper—rayon or nylon laminates—a major marketing battle is looming." This is covered in detail by **Edward McSweeney**, management and marketing consultant to Paper and Allied Industries, including Printing Industries of America, Inc., in *Pulp & Paper* for December 5, 1965, in an article entitled, "Which Way Will the Paper Tiger Jump?" Edward is chairman of the Trustees of Printing Management Education Trust Fund. There is a picture of Edward and another picture of the Trustees including Edward in *Printing News* for December 3, 1966, and also an article entitled, "Educational Fund Trustees Studying Plans for Helping Management Meet the Future." Edward spoke on November 18, 1966, at a meeting at the Metropolitan Club in New York City and discussed plans for increasing the management development activities to be sponsored by the Trust. In his remarks he said, "Printing today faces not merely a whirlwind technological change but also a marketing revolution." Edward is also a New York consultant in the graphic arts in the international field. There is an interesting article by him in the fall of 1966 *Columbia Journalism Review* entitled "On the Horizon: Journalism's Successors?" This article outlines some of the joint ventures being undertaken by giant electronic corporations of educationally oriented publishing companies. He ends by saying, "Editorial leadership still remains the irreplaceable element. As long as the human element predominates, the new medium will not become the captive of the machine. Meanwhile there is nothing you can do except to follow the dictum of the great Karl Compton, 'Expect and enjoy change.' . . . **Bertrand A. McKittrick** reports, "I am not retired but am trying to change direction a little with indifferent success." His son has become president of the McKittrick Company and Bertrand is now chairman of the board. This last year Bert accepted directorships in Phillips Screw Company (A.S.E.) and Kelox Industries (East Boston), plus memberships on the Board of Investment of the Central Savings Bank in Lowell, Mass. He is also chairman of the board of F. W. D. Corporation, Clintonville, Wis., F. W. D. Wagner Corporation, Portland, Ore., and F. W. D. Canada Corporation, Kitchener, Ont. In his note he says, "We did not take a winter vacation this year, but spent the last week in May at the Homestead, Hot Springs, Va., the week before July 4 at Black Point Inn, on the coast near Portland, Me., and the first week in August, a cruise on the *Carmania* down the St. Lawrence from Montreal to the tiny French-held islands of St. Pierre and Miquelon, off the southern coast of Newfoundland. . . . **M. L. Flickinger** reports: "We are fine as usual. It is amazing how busy we keep retired! [I fully agree with you, Flick] We intend to stay home this

winter, probably will drive to San Francisco and Yosemite in June, with stops in Colorado. We went to Florida last March, then Cape Cod and New England in October. The colors were spectacular, weather cool. . . . A Christmas card from **Herbert L. Hayden** included evidence, in map form, showing that he has been keeping in physical form by considerable senior tennis tournament (eight listed) and hockey activity. Also, bowling twice a week. His map shows that he has traveled from Jefferson, N.H., to Nashville, Pa., to St. Petersburg, Fla., with other travel and fishing in Nova Scotia. He says further, "While having lunch in the '1700' Restaurant in Philadelphia with friends we had met in South America, had a chat with **Edward J. Healy** who was there.

. . . On a Christmas card to the **Forrest F. Langes** from all the **Julius A. Strattons** was written "with deep appreciation for the original [color] print of the presentation of that beautiful tray. What a memorable night it was!" (See November issue, page 68). . . . **John E. Burchard**, Dean of the School of Humanities and Social Sciences at M.I.T. for 16 years prior to joining the University of California at Berkeley in 1964, has been named acting dean of the College of Environmental Design. He replaces Dean Martin Meyerson who will become president of New York State University, Buffalo. . . . The Alumni Office advises of the following changes of address: **John E. Burchard**, 1319 Brewster Court, El Cerrito, Calif. 94530; **Miss R. M. Karapetoff Cobb**, 12 Southlawn Ave., Dobbs Ferry, N.Y. 10522; **Maxwell B. Donald**, Rabbott Shaw, Stagbury Ave., Chipstead, Surrey, England; **Henry B. duPont**, 9046 duPont Bldg., Wilmington, Del. 19898; **Mrs. Marion Warner Hovey**, 139 South 6th East St., Apt. 4, Salt Lake City, Utah 84102; **E. Fletcher Ingals**, Old Woodridge House, Old Mystic, Conn. 06392; **Richard C. Kleinberger**, 1 East Post Road, White Plains, N.Y. 10601; **Richard P. Ovenshine**, 2111 Jefferson Davis Hwy., Arlington, Va. 22202; **James A. Pennypacker**, Long Hill Rd., Essex, Conn. 06426; **William F. Perkins**, 897 Webster St., Needham, Mass.

Henry B. Kane, '24, emeritus director of the M.I.T. Alumni Fund, received the distinguished service award of the New England District of the American Alumni Council in Boston on January 9 for his 26 years' service in alumni work at M.I.T. Kenneth C. Parker of Trinity College, New England AAC Chairman, made the presentation.

PHOTO: MRS. RUDOLF O. OBERG



02192; **Hugh Perrin**, Box 326, No. Chat-ham, Mass. 02650; **Ralph E. Rubins**, 535 So. Alandale, Los Angeles, Calif. 90036; **C. Russell Ellis**, Buckingham Apts., 253 Garth Road, Scarsdale, N.Y. 10583; **John F. Wendt**, 6 Schuyler St., New Rochelle, N.Y. 10801; **U. A. Whitaker**, AMP Inc., P.O. Box 3608, Harrisburg, Pa. 17105; **George A. Brown**, 2 Rowland Ave., Lexington, Mass. 02173; **Laurence S. McLane**, Apt. 203, 999 Wilder Ave., Honolulu, Hawaii 96822; **Elwood A. Windham**, 9 Pound Edge Rd., Westport, Conn. 06880.—**Forrest F. Lange**, Secretary, 1196 Woodbury Ave., Portsmouth, N.H. 03801; **Bertrand A. McKittrick**, Assistant Secretary, 78 Fletcher St., Lowell, Mass. 10852

'24

One of the hazards of writing these notes at home is the almost complete absence of any effective filing system. Some of the items that come to hand sound very familiar, as though they had been written into last month's column. And although there is a copy somewhere around the house, it never comes to light at the opportune time. So if some of you get double billing, don't be surprised. Memory is a fallible thing, at best. . . . Out in Cleveland there is a joint venture under way between Case Institute and Western Reserve University. Four academic departments have been established to serve both institutions. This came about as the result of recommendations from a high-level study commission whose membership included **Harold Hazen**. Harold, as you know, is dean of M.I.T.'s Graduate School. And to give the commission an even greater M.I.T. complexion, another member was David A. Shepard, '26. Mentioned in dispatches as being present at a meeting unveiling the new plan was **Hayden B. Kline**, an Honorary Trustee of Case. If that fallible memory is correct, Hayden is now retired from the presidency of Industrial Rayon. . . . Harold Hazen gets into all manner of things. Back in 1965 the American Society for Engineering Education sponsored a World Congress on Engineering Education. Harold was a member of the committee that planned it. It took quite awhile for the many papers given there to appear in print, and only when that happened were we aware of the fact. Sorry about that. . . . After 38½ years with Marshall Field in Chicago, **Dick Chapin** has retired. He has been in charge of construction and maintenance, and as their suburban stores mushroomed he's had a constantly expanding and varied job. Have no idea what his retirement plans are, but at one time Dick studied both architecture and oil painting. Could be the lake front will see some mighty fancy painted houses in the future. . . . We told you we'd try to get further information on the recent Billard nuptials. We have, to the extent of the formal announcement. "Mr. Ralph Thompson has the honour of announcing the marriage of his daughter, Velma Victoria, to Mr. Gordon Youngs Billard, Tuesday, the second of August, One thousand,

nine hundred and sixty-six, New York." . . . By the way, here's something you probably don't know about. Some years ago Gordon established the **Gordon Billard** Awards "for outstanding service to the M.I.T. community." This year the award went to William H. Carlisle, Jr., '28, for "serving with warmth and affection the abiding purposes of the Massachusetts Institute of Technology." Bill Carlisle is known to and loved by every student who has worked to help pay his way through the Institute during the past 40 years. After graduation he became assistant manager of the dining service at Walker, and for the past 15 years he has been manager of student personnel. More grateful alumni come back to see Bill Carlisle than anyone else at M.I.T. There could be no one better qualified to receive the Billard Award. . . . Phelps Dodge evidently decided that **Ed Dunlaevy** wasn't busy enough as president of P. D. Copper Products. Recently they set up a new management company, P. D. Industries, Inc., "to coordinate its growing activities in the manufacture and sale of copper, aluminum, and related products." It's a so-called corporate realignment, with seven subsidiaries coming under its wing, including the Copper Products Corporation. . . . While Ed Dunlaevy is having more responsibilities piled on his shoulders, **Ed Hanley** is getting ready to shed his. Allegheny Ludlum has promoted Ed's chief assistant to executive vice-president, putting him in line for the presidency when Ed reaches mandatory retirement age in February 1968. "The move will probably come in mid-1967," said the always-omniscient company spokesman, "with Mr. Hanley retaining the titles of chairman and chief executive officer." With all of his directorships and other interests Ed will still be a busy man. Maybe he'll devote some of his energy to revitalizing the Pittsburgh Steelers. They could do with a bit of the magic Hanley touch. . . . **Hap Stern** has evidently decided that winter golf is a happier sport in Florida than New England. When the days got shorter and colder last fall, the Sterns headed south for Palm Beach. . . . We don't know what prompted **Paul Schreiber**'s move, but after a relatively short stay in Boston he has returned to Midland, Mich., his former base of operations. As this is being written, the Midwest is "locked in the grip of sub-zero cold," as the weathermen are wont to put it. Paul probably wishes he'd been shifted to his company's Florida office.

It is our sad duty to report three deaths in the class. **Douglas F. Elliott**, as an undergraduate, was active general manager of *Tech Engineering News*. After graduation he joined the construction department of the Alabama Power Company in Birmingham, and was made vice-president for construction in 1959. Some years ago he had a heart attack but kept on working until the end of last year. On January 12 he died. Doug was an Educational Counsellor for many years, interviewing boys who had M.I.T. in mind. He was active in a number of professional societies and was a vestryman in his church. . . . **Robert D. Foster** also died in January. Originally in the

class of 1923, Bob graduated with us. He spent his working life as a stockbroker, in recent years with Paine, Webber, Jackson and Curtis in Boston. Bob was a regular attendant at our reunions on the Cape. . . . Last November **James D. Taylor** died in Boston. He had a varied career, primarily as a teacher in Florida and Boston. . . . When you read these lines, spring will be just around the corner, but as they are being written in the early morning the temperature is hovering around zero. However, this is of little concern to a retiree. The thermostat has been jacked up a notch, and the resolve has been made not to step outside today. There are plenty of good indoor jobs waiting. As shivering commuters tear by on their way to catch the 8:03 or to fight other impatient commuters on the inadequate approaches to town, a certain amount of smugness is inevitable. "There, but for the grace of God, go I."—**Henry B. Kane**, Secretary, Lincoln Road, Lincoln Center, Mass. 01773

'25

It is fortunate that we have **Kamy Kame-tani** in our class or news for this issue of the Review would be most difficult for your Secretary to dream up. Because the new issue of the Alumni Register is in preparation, a number of addresses are being verified by the Alumni Office; but during the past month there has not even been an intriguing address change, nor has there been a news item concerning any member of the class! A nice Christmas card from Kamy, however, indicated that he might visit this country during 1967; and of course if this happens, he will be greeted by classmates wherever he may go. A few days after his greeting card reached your Secretary, a note came from him saying that he was retiring from Ishikawajima-Harima Heavy Industries Company, Ltd., Aircraft Engine Division, in Tokyo. He noted further that he expects to be assisting Mr. George E. Grega, Vice-president, Pacific Operation, General Electric Technical Services Company, Tokyo. If any of you are visiting Japan, you would make a serious error if you do not attempt to get in touch with Kamy. . . . Word recently reached the Alumni Association Office indicating that one of the 1925 coeds, Miss **Frances S. Hopkins**, died in Cleveland, Ohio, on August 30, 1966.—**F. L. Foster**, Secretary, Room E19-702, M.I.T., Cambridge, Mass. 02139

'26

Getting organized for this issue has used up the two hours usually allocated for writing class notes. It's January 8 here in Pigeon Cove although these are March notes. January means turning over a new leaf, and our class notes folder had been getting so bulky that it no longer would slide under the bottom shelf in the HiFi closet. When anything connected with the class comes, in it goes into the folder until class notes time. During a reunion year

there are a lot of communications that find their way into the file because they look like useable material. Today was the day of reckoning, and we have filled an enormous wastebasket with reunion forms, duplicate clippings, address change cards, etc. However, out of the lot we have culled some items that will get us started. There were lots of notes from those who had been at Pigeon Cove and many Christmas cards, but most of these were personal and not for the class notes. One interesting Christmas card from Kay and **Dave Shepard** included a color photo of them in western finery on horseback during their vacation last summer. In the photo Kay shows up definitely taller than Dave, and I'm still trying to figure it out. . . . Another photographic Christmas card shows **George Makaroff** standing on what Ruth said was the Alps but George said: "George! As you can see I am still hiking mostly in the Adirondacks. Have been using my old M.I.T. belt buckle as a bait in the woods. The catch so far: one M.I.T. man (not a classmate) acting as a summer fire warden on trails. Best as always, George M." . . . **Dave Harrison's** Christmas seven-page booklet which always featured the children now is 100% grandchildren. . . . The **John Longyears** always send out herbs with a recipe for their use—this year the herbs were for perfume only. . . . Among the reunion notes we find one from **Al Entwistle** to "Pink" **Salmon**, "I am in the midst of a heavy building program and unfortunately for me I cannot attend the 40th. Will you kindly express my regrets to the boys and all the committee who have worked so hard. With best wishes for a grand reunion. Sincerely, Al." . . . Another note is interesting because I cannot recall ever hearing from **Ariel F. Horle** since graduation—the note: "Had definitely planned on attending, but other commitments in early summer have made this impossible. A. F. Horle." . . . Here's a note from **"Pete" Ruggles**. "Hello George, I happened to be looking through the November issue of the Review and noted you will send a list of those in attendance at the 40th. I'd like a copy. My wife and I had thought we'd be present, but! We ended up going to the Scandinavian countries for about eight weeks returning by early June—in time to miss it. We did get into the special concert for the new proxy in October. I did see 'Pink Salmon' from a distance and many others I was able to reach. I get a kick out of the Review—it helps keep me posted 1917-1928 in spite of the fact I was originally 1924 but wound up 1926. Sincerely, H. C. 'Pete' Ruggles." . . . In the folder we came across a list of Special Gifts Chairmen who were awarded Certificates of Appreciation by the Alumni Fund Board for outstanding work in 1966. On the list of fifteen is **William M. Davidson**. A cleaning out does wonders because I also turned up the list for 1965 and find the name of **M. Bernard Morgan**. Congratulations Bill and belated congratulations Bernie. . . . Among the regional chairmen appointed for 1967 is **Herbert T. Creedon** of New Canaan, Conn. . . . A class Secretary receives copies of address changes from the Alumni Register. There

is no comment other than the source and date of the information. If it involves a drastic change in address, your Secretary wonders and sometimes he writes to see what it's all about. Here are some address changes that I will let you wonder about with me: George W. Breck, P.O. Box 468, Manomet, Mass. 02345; Samuel W. Brooks, 26 Young Road, Falmouth, Mass. 02540; Robert W. Conly, Scudder Lane, Barnstable, Mass. 02630; Melvin C. Dow, 850 Victor Herbert Drive, Largo, Fla. 33540; Philip M. Hulme, The Orme School, Quarters Circle, Bar Ranch, Moyer, Ariz.; Stuart W. John, 1829 Nursery Road, Clearwater, Fla. 33516; Kilian V. R. Lansing, Condominio Guadalajara 1802, Guadalajara, Jalisco, Mexico; Alfred W. Lash, R.R. 1, Saanichton, British Columbia, Canada; Charles E. McCulloch, 27 Queens Gate Gardens, London SW7, England; W. Winsor Peterson, Pine Woods Road, Pittsford, Vt. 05763; Domingo J. Valdes, Apartado 7, Gomez Palacio Dgo, Mexico; and Allen L. Willis, 24 Cedar Lane, Briny Breezes Club, Delray Beach, Fla. 33444. This batch of address changes with the exception of Charlie McCulloch looks as though many classmates were retiring to places away from the business centers. Let us see how many will write in and confirm or deny it or just tell us about it. We haven't talked about Pigeon Cove this trip, but we have been working down in the study away from the sea. It's a dismal rainy day but snow has been the prediction. I should have had a fire glowing in the corner fireplace, but somehow I had not intended to spend all morning here. I have promised Heather that I would take her walking, so I'll have to run out on you to keep my word with this young collie who still chews up anything she can find that is of any value. You can see that after this morning's housecleaning the class folder is getting thin again, so how about sending a short note telling of your plans? We will be needing it. So until April, Cherrio.—**George W. Smith**, Pigeon Cove, Mass.

'27

40th CLASS REUNION
June 9, 10, 11, and 12

"When I read the 1927 class notes in the December issue of the Review, I was surprised to find that I had apparently been leading a double life for the past two years—working for Lockheed-California in Burbank while leading my family, friends and clients to believe that I was practicing law in Wilmington, Del. With all due respect to Lockheed and California, I am still busily engaged practicing law in little Delaware." So writes **Arthur G. Connolly**, and it was all my fault. Our class has two Connollys, two Connors and one Connell, but the fellow who works for Lockheed just isn't even a member of our class. Our Art is the senior partner of Connolly, Bove & Lodge, has six children. The oldest is a partner in the above law firm; the youngest, Tom, is a high school freshman. Since Art—as he says—put the slide rule away in moth balls, his work has been mainly in patent, antitrust and unfair competition law. This has pro-

vided plenty of travel but he says, "Strangely enough, despite my frequent jaunts, I seldom run into any classmates. If the law of averages still holds I hope to have the pleasure of coming across more of them in future years. In any event I hope to attend the 40th reunion with all the other antiquated specimens of circa 1927." . . . In sending a fine 40-Year Gift check to **Bud Fisher**, **Erik Hofman** adds a few lines about his retired life in the Island of Mallorca off the east coast of Spain. He too says that he hasn't seen many of the 1927 group for a long time. "We are pretty well established here as a base from which we can travel easily. It is a delightful place. We overlook Palma, a busy city of 200,000, its harbor, its bay and airport, yet the front of our house is in a small and convenient village. Even now, in the dead of winter, it only goes to the middle thirties at night, while the days are sunny, calm and in the high sixties. Summer days get (sometimes) in the early nineties, but we always have an on-shore cooling breeze midday. After having lived in a great many countries, this place is hard to beat. If 1927 friends are coming this way, do have them let me know by letter or cable." I know we all hope that we can be the one to do it. . . . The notes of 15 years ago record that **George Houston** had been appointed manager of manufacturing training in the General Electric Company's personnel development department. Colonel **Bill Berkeley** was conducting economic mobilization courses for the Industrial College of the Armed Forces at Des Moines, Iowa. . . . Suggestion! Those of you who had plans

to write to your class Secretary, write a check instead and send it to **H. W. Fisher**, Room 2815, 30 Rockefeller Plaza, New York, N.Y. 10020. The Class Gift needs YOUR help.—**Joseph S. Harris**, Secretary, Masons Island, Mystic, Conn. 06355

3
how I ever had time to work. This card is from Lake Constance. Nat and I are touring Germany and environs in a new Volks, which is a very nice little car. Anyway, I'll see you at our 40th."

We received a January 9 letter from Gordon Calderwood, '27. "The enclosed clippings from Winnipeg papers came to me from a long time associate of **Jack Russell** at the University of Manitoba. Jack, Don Dunklee and I were fraternity associates back in the late 20's. The clippings report an unusually active life. Friends will always remember Jack for his warm, unselfish manner." Excerpts from the clippings follow: "On December 28 at Deer Lodge Hospital **John Alonzo Russell**, husband of Shirley Beatrice Russell, of 740 South Drive, Fort Garry, died at the age of 59 years. Funeral services were held under Christian Science auspices at the Gardiner Funeral Home, 178 Kennedy Street, York. Dean Russell was born at Hinsdale, N.H., receiving his early education in Brattleboro, Vt. He received his Master's Degree in Architecture from the Massachusetts Institute of Technology and held a diploma from the Fountainebleau School of Fine Arts. He joined the University of Manitoba in 1928, and was professor and head of the School of Architecture until appointed dean of faculty of architecture. Besides his wife, he is survived by one son, Barry, of Toronto, and one daughter, Nancy, at home; also his mother, Mrs. H. H. Russell of Brattleboro, Vt." And from the editorial page of the *Winnipeg Free Press*, we quote: "Of architecture, Longfellow wrote: 'Ah, to build, to build! That is the noblest art of all the arts.' The art of architecture in Canada was immeasurably enriched and enhanced over the past 38 years by the work and personality of Professor John A. Russell, Dean of the Faculty of Architecture at the University of Manitoba, who died on Wednesday. To list Dean Russell's accomplishments and the honors that these brought to him would take many words. There was no phase of his profession in which his influence was not felt. His interests extended far beyond his home city of Winnipeg and far beyond his own profession, to embrace such artistic areas as the theatre and the ballet. Born and educated in the United States, he came to Winnipeg in 1928 and had made this city his home since. In his years here he made a distinguished and outstanding contribution not only to the profession of architecture but to his community and to the nation as a whole. His death at the age of 59 leaves his many friends and colleagues with a deep sense of loss which even the knowledge that he will long be remembered both for himself and for his works cannot assuage."—**Herman S. Swartz**, Construction Publishing Company, Inc., 27 Muzzey St., Lexington, Mass. 02173

'28

From the General Radio Company we recently received the official news release which informed us that our own class agent **Charles E. Worthen**, Director of Sales Promotion at General Radio Company, has retired after a 38-year career with General Radio. A graduate of M.I.T., he joined General Radio in 1928 as a development engineer. For the past 30 years he has been editor of the General Radio Experimenter and has directed the firm's Publicity and Sales Promotion Departments. . . . A letter from **Ray Wofford** to **Jim Donovan** with carbons going to **Homer Burnell** and **Bob Krummel** states: "Many thanks for coming down from Cambridge to attend the '28 class luncheon at the New York Chemists on December 1. The plans you outlined for our 40th Reunion in June 1968 sound great. It is unfortunate that more classmates could not attend and express their ideas and suggestions. Also, they missed an excellent showing of slides of classmates at previous reunions by **Ed Ure**, **Ted Pierce** and **Bob Krummel**. As you know, 20 were on hand for cocktails and lunch, including **Jim Phinney**, Executive Secretary, M.I.T. Alumni Center of New York. Typed letters (thanks to my secretary, Mildred Schmitt) were mailed to 86 classmates residing in the New York area. Classmates attending were: **Albert Dempewolff**, **Jim Donovan**, **Bill Du Vernet**, **Newton Foster**, **Lazare Gelin**, **Wally Heidtmann**, **Terry Hurlbut**, **Bob Krummel**, **Tom Larson**, **Frank McDermott**, **Frank McGuane**, **Bill Murphy**, **Bob Murphy**, **Bill Phillips**, **Ted Pierce**, **Claude Rice**, **Frank Sweeney**, **Ed Ure**, and **Ray Wofford**. Also **Morey Klegerman** and **Leon Gaucher** wrote notes and **Henry LaCroix**, **Bob Larson**, **Hal Porter** and **Ed Walton** telephoned their regrets that previous plans interfered and prevent them from attending. Our next class luncheon is scheduled for January 12 at the Chemists Club and we hope all can attend. Bob Krummel handled the arrangements for this luncheon as well as the two previous '28 luncheons held this fall, and his efforts are greatly appreciated." . . . A couple of memos from Jim tells us that **Newton Foster**, living in New Jersey and present at the New York luncheon, does a tremendous amount of work for M.I.T. He recently found time to visit Mexico, where he had luncheon with **Walter Nock**. And recently **Florence Jope** and the **Donovans** received books by **Olive Foster**, *A History of the Hajji Baba Club*, an organization with dedicated interest in the fine arts, oriental rugs in particular. . . . A recent card from **Des Shipley** states, "I received your recent note and plan to help with our class reunion; but I have been so busy since I retired that I have no idea of

'29

It was a pleasure to meet with the group working on the Reunion Gift drive at the Faculty Club on January 5. **Bill Bowie**, Ken Brock, Frank Meade, Bill

PLAN AHEAD for your CLASS REUNION!!

Mark these dates down
on your calendar

June 9 10 11

AND

Alumni Day June 12

- Renew old friendships
- Relax and enjoy a wonderful week-end
- Then come back to the campus and witness the many changes, see, meet and talk with the faculty and listen to the dynamic seminars on Alumni Day

MAKE YOUR RESERVATIONS NOW

... Full details are on the way

Baumrucker, John Fahey, Paul Donahue, and Eric Bianchi were there and all are certainly bending every effort to accomplish the objective of \$625,000 for our 1969 Reunion Gift. They are devoting much of their time in this campaign in contacting classmates throughout the country and, in fact, all over the world, and should be congratulated for their fine work. The next step should be an overwhelming response from all of the 29'ers which I am sure would be much appreciated by the committee, in addition to making the 1969 Reunion Gift to M.I.T. one which we can all be proud of as class members. . . . We were very sorry to learn that our past class president, **Brig Allen**, had suffered a stroke last August and has been pretty much incapacitated since that time. He says he is now able to walk, drives the car a little bit, and spends half a day at the office. Hope each day brings you new strength, Brig, and we look forward to seeing you at the 40th. . . . A Christmas card from **Ross Pfalzgraff** brought news of his recent activities. In a note he says, "Have been doing some very interesting and challenging management consulting projects with some fine Indian Houses in New Delhi Calcutta. Enjoy working with the Asians but am saddened by the shape they are in with the exception of Taiwan and Japan." Ross's home address is 423 River-view Road, Swarthmore, Pa. Thanks for the card, Ross. It was nice to hear from you. . . . The Alumni Register sent us a news clipping about **Renato Fracassi** who had joined the Development and Research Department of the American Telephone and Telegraph Company in 1930 where he engaged in systems engineering work. In 1934 he joined the Bell Telephone Laboratories where he participated in many of their development programs. At present he is in charge of a group concerned with wideband data systems. . . . Also, from the Alumni Register we have word of the death of Rear Admiral **Nolan M. Kindell** in October 1966. Admiral Kindell's address was listed as Cedarville, Mich. . . . The information on the graduates of the class of 1929 which we obtained by questionnaire at the time of the 35th reunion will soon all have been reported in these columns. We would invite ten brave souls to write in recommendations for their best suggestions for a "fresh view" of our class. Best regards.

—**John P. Rich**, Secretary, P.O. Box 503, Nashua, N.H. 03060

'30

During the past month reports have come in from two of our three **Fosters**, **Richard G.** and **Robert A.** Dick is a food technologist in the International Department of Campbell Soup Company in Camden, N.J., and lives in Haddon Heights. He was recently appointed to the Haddon Heights Board of Health. His son Donald graduated from Bucknell and daughter Susan from the nursing school of University of Rochester. . . . Bob has his own consulting and construction business in Penacook, N.H. He is treasurer of

Merrimack County, a Trustee and Chairman of the Building Committee of Concord Hospital and a past president of the Rotary Club. . . . **George Gassett**'s musical activities are currently so multifarious that it is difficult to see how he finds time for his job as Senior Engineer at Stone & Webster Engineering Corporation. He is a director of the Hingham Civic Orchestra in which he plays the clarinet and flute, 1st clarinet in the Rockland Concert Band, 1st flute in the Brockton Legion Band, alto saxophone in the Brockton Cosmopolitan Band, and a trustee and director of Local #138 of the American Federation of Musicians. The Gassett's older daughter Gretchen graduated from University of Massachusetts and is now an executive secretary with N. E. Life Insurance Company in Boston. Quinby Marcia attended Garland Junior College and is now a stewardess on the E.A.L. Boston-N.Y. shuttle. George reports that he sees **Ed Kingsley** occasionally and that Kitty and **Frank Fahnestock** spent a weekend at the Gassett's last summer. . . . **Charles Gale** is advertising manager-publications of the American Oil Company in Chicago. . . . **Dave Giller** is a self-employed structural engineer in Boston. The Giller's daughter Evelyn attended the Boston Museum School of Art and has a B.A. from Tufts. . . . **Harold Fine** has his own consulting firm in Boston, H. D. Fine & Associates, Inc. The Fines have two sons: Stephen who received a B.S. from M.I.T. in '63, and M.S. from Brandeis in '65 and is studying for a doctorate at Northeastern, and Jeffrey who graduated from Amherst in '66 and is studying for a doctorate at Harvard. Harold is a past president of the Boston Stein Club. . . . **Harry Fekas** is doing electrical engineering research work at Langley Air Force Base and lives in Newport News. He served two years as deputy director of civil engineering at Albrook & Howard A.F.B. in the Canal Zone, and while stationed there traveled extensively through Central and South America. Harry and Athene have two married daughters, Joan and Mary, a son George and six grandchildren. George graduated from V.P.I., did graduate work at Iowa State and now works for Ortho Diagnostics. Harry is active in the local Community Concert Association, Peninsula Arts Association and Virginia Peninsula Engineers Club. He reports having recently seen **Harry Poole** who works for the Department of Defense in Washington. . . . Changes of address: **William E. Cullinan, Jr.**, 1 Stonehill Dr., Stoneham, Mass. 02180; **Lawrence N. Gonzalez**, Avda. Generalissimo Franco, Madrid, Spain; **Alfred M. Luery**, 413 Harbor View Lane, Harbor Bluffs, Largo, Fla. 33540; **Morell Marean**, The Mareans, 214 Washington St., Marblehead, Mass. 01945; **Horace W. Myers**, 1439 Apona St., Honolulu, Hawaii 96819; **Henry O. Pattison, Jr.**, 737P-Rt. 2, Tucson, Ariz. 85715; **James M. Pickell, Jr.**, 167 Broad Ave. So., Naples, Fla. 33940; **W. Howard Reed, Jr.**, Town House 215, 2500 Tapsfield Road, So. Bend, Ind. 46614; **George W. Schaible**, 1052 Chinaberry Rd., Clearwater, Fla. 33515; **Theodore E. Waddell**, 14 Gail Drive, No.

Haven, Conn. 06473—**Gordon K. Lister**, Secretary, 530 Fifth Avenue, New York, N.Y. 10036

'31

Best wishes to all of you for 1967. A thoughtful note from Charlotte and **Ed Hubbard** on their Christmas card reported, "Our youngest, Posie, was married at Thanksgiving time and returned to Los Angeles with her husband where she teaches French in Palos Verdes High School, and John (Ondreck) is at Douglas Aircraft representing Hamilton Standard Propeller. The other two have given us four grandchildren to date, and we thrive on it." I can just picture Ed and Charlotte crawling around the floor and having a grand time with those grandchildren. . . . Talked with **Fred Elser** by ham radio recently. He and Mardy had a pleasant trip to the Philippines, but were glad to get back to their home in Palm Springs, Calif. Mardy Elser is making quite a name for herself at bridge. . . . **Harold M. Wilson**, who has been with General Radio Company since 1945, has recently been named senior vice-president. . . . **Elliot Whitaker**, Director of Ohio State University's School of Architecture and Landscape Architecture, has received a citation in appreciation for "advancement of architecture education" from the Association of Collegiate Schools of Architecture. . . . It is always a shock to hear of the death of any of our classmates—especially those whom I knew well during our undergraduate days. This month word has been received that the following classmates have passed away: **Robert S. Backus**, **Myron Burr** (just before Christmas), **John J. Kennedy**, **Walford Walden** and Captain **Paul C. Wirtz**. . . . New addresses reported include **William C. Lamb**, Latin American Gulf Oil Company, P.O. Box 910, Coral Gables, Fla. 33134 and **Donald E. Stearns**, P.O. Box 129, Dacca, East Pakistan.—**Edwin S. Worden**, Secretary, 35 Minute Man Hill, Westport, Conn. 06882

'32 CLASS REUNION

June 9, 10, and 11

Three months to go before the 35th Reunion at the New Ocean House, Swampscott, Mass., on June 9, 10, 11, 1967. Please return the tear-off in the direct mailing to give us an indication of your interest. The hotel reservation forms you will receive should be returned to the hotel. Pass the word.—**Elwood W. Schafer**, Secretary, Reunion Chairman, Room 13-2145, M.I.T., Cambridge, Mass.

'33

Again we are off and running and well into the New Year as these notes are read by the faithful. Our story starts this time with an account of a visit I had November 27 with whom might well be our number one classmate, exclusive of

the President and Executive Vice-president. He is one Vice-president of our many Vice-presidents. I refer to **Cal Mohr** who, on the above date, my birthday and a Sunday, came 40 miles into Chicago to visit with me. We had a long visit before going across the street to the Hilton Hotel for dinner. Only incidentally, Professor Loring V. Tirrell, Department of Animal Science, University of New Hampshire, was with us. Quite naturally Cal and I did a bit of reminiscing, covering lots of years. Although I knew something about Cal and his work, I asked him to tell us a little about filters for the benefit of the Professor. The filter discussion, with questions and with related subjects, really turned out to be something extraordinary. Cal held both of us fascinated for an hour. We had an excellent dinner, after which Cal took off for North Aurora, Ill. After Cal left Professor Tirrell said, "What a brilliant, well-informed and charming fellow!" I told the good Professor that all M.I.T. men were that way, or had he not noticed? Cal had little new information, as he had already furnished a large part of the note material for February, but he would send in more for March. And he will, though as of December 18th it is not yet here. It does us all good, once in awhile, to chat with a classmate. It helps to have another who knew us when, and who remembers. We talked over so many fellows as to cause us both to wonder how it was possible that we had so many mutual friends. And that is just about what is done at the reunions. We talk it over. Just as a for instance, is it not worth a few minutes of anyone's time to discuss **Lew Flanders** in the "Rumble Seat" of a Ford Coupe, with a bass drum and a bull fiddle? Cal did not see that, but he heard about it, as someone drew a cartoon about it and put it on the board near Mr. Hartwell's Office in the Dorms. . . . I have a short note on his Christmas card from **Harry Summer**, Chicago, with best season's wishes from Cele and Harry and the boys to all of us.

A note from **Warren Pease**, XIII, tells me that he is class of 32½; it appears that Warren had a long illness which prevented his taking his degree on time in 1932, so that he had to return and got it in 1933 with us. That makes him class of 1933 according to the rules. Warren is in excellent health, and still holds down his job as assistant treasurer of the Groton Leatherboard Company. He allows that the treasurer has never been active. He has what might be expected as a hobby; boating and boat building. He rides the boating hobby during the summers at Annisquam, Mass., and builds sailing dinghies in his shop during the winters. He is also a grandfather and a new member of the club, with two married sons, both with children. One son lives in California and the other in Virginia, which keeps the Pease family busy traveling in order to get in the expected family visits. Warren used to be quite active in hospital work as well as other civic activities, but now leaves such things to the younger men, and admits that he seems lazier than formerly. Well, Warren, the famous Pease demise case is closed, though **Ellis Littmann** manages to squirm

out from under by sending me a photostat of some Pease 72 years old from Detroit, a Hogan trophy winner, who reminds him of you. . . . Wonders seem never to cease. Now comes a letter and a brochure from Bell Haven Park and **Charlie Bell**, who has a mobile home park in Miami, Fla., with 30 acres, and 400 spaces, at NW 79th Street and 32nd Avenue. I now quote as I cannot improve on Charlie, Vice-president of the class of 1933: "Helen and I have a daughter Nancy, married and with two children, in San Francisco; a daughter Susan, married and with two children, in Galveston; a son David, a senior at Harvard who expects to enter Harvard Medical next year; and a daughter Emily, age 11, in grade school, a ball of fire I might add. I left Leesona Corporation in 1956, after 10 years as vice-president in charge of research and development, textile machinery, (a competitor of W&S); since then have been running the following businesses: Bell Haven Park, mentioned above, Bell Brothers Company, active in Real Estate in Dade and Broward Counties, Fla., mostly leasing, and Bell Factory Terminal, Inc., an industrial development in Garwood, N.J. We build and lease factory buildings, are located on the Central R.R. of N.J., and presently lease about 20 buildings to a variety of tenants. Lastly, engineering consulting. With local managers of the above three, I am devoting half time to research and development in New England consulting. This usually involves design of automatic machinery of my own concept. I am currently retained by Leesona Corporation. Independent consulting works out well as it gives me the flexibility necessary to handle other matters as they come up. We keep busy and enjoy good health and life. Our best regards to you and Leona." Thanks, Charlie. Your classmates and I appreciate the effort it took and seems to take to tell a long story briefly and in an interesting manner. . . . I have another Season's Greeting from Green Turtle Cay, **Walt Skees**, in the form of a flyer on the "Abacos," where Walt has his cottages. Thanks, Walt. . . . **Charlie Fulkerson** sends in a short and sweet note on the Fulkersons, hither and yon, though he says there is not much news. His three oldest children are in California near San Francisco. Chuck, Jr., is a freshman at Stanford, studying art, creative writing, etc.; Martha is teaching in the San José elementary schools; and Mary and husband get out of the Navy this month (December). "Elizabeth, Heidi, age 9, and I have just returned from Thanksgiving at Williamsburg, and expect to spend Christmas at home. The rest of the family is just too far away right now." Charlie sees **Ed Goodridge** once in awhile, at Lake Candlewood (Goodridge summer home). He also sees **Cy Hapgood**, (NR), a classmate attorney who handles Charlie's patent work. Charlie also occasionally sees Dick Stewart, '32, who lives in Waterbury, or near there. Charlie has dropped a lot of his civic activities, of which he used to have many. He still is on the Historic District Commission of Roxbury, Conn., and on the local School Board which, he says, is enough.

We have address changes: **Miner D. Allen**, XV; **Geo. H. Bartlett**, XV; **Harold E. Conger**, I; **Jack F(rost) Andrews**, XV; **Robert H. Dodd**, (NR) X, **Harold S. Farney**, I, (I would sure like to hear from Alaska, friend); **Stanley Gilbert**, III; Professor **Frank Gilmore**, IV, **Outerbridge Horsey**, XV, (NR); **Everett L. Hume**, IV-A; **Ferd Johnson**, II; **Roland L. Lee**, **Ellis C. Littmann**, Vice-president and Estates Secretary, XV; **John I. Lynch**, II; **Miss Madeline E. Lynch**, I; **Robert G. McKay**, XV; **Courtenay Marshall**, I; **Robert O. Nichols**, VI; **Stanley Ott**, IV; **Alfred G. Payne**, VI; Dr. **Quintin P. Peniston**, X-A; **Matthew Piskadlo**, (NR), I; **Edward S. Rowell**, XVII; **Lambert G. Snow**, III; **Ernest W. Spannake**, (NR), II; **Horace W. Taul**, I; **Gordon C. Thompson**, XVI; **Harris A. Thompson**, VI-A; Dr. **Theodore B. Wiehe**, XV. If any of the faithful wish to have any or all of these address changes, they have only to write Ye Scribe, but include some usable information. . . . We are all saddened to hear of the passing of another classmate, **Leland L. Lewis** of Seattle, Ore. He came from Eugene, Ore., originally, and a very nice note from Mrs. Lewis in reply to one of mine tells me that he returned to Oregon right after graduation and had worked at Boeing on the Guided Missile program and more recently on the Minute Man setup. Married in 1940, the Lewises have two sons, one married, with children, and the other apparently not married who is also with Boeing. The elder of two daughters is a junior at Whitworth College, and the younger has just entered junior high school. I know that you all, especially those of you who were in Course IV-A, join me in offering Mrs. Lewis and her children our most sincere sympathy. . . . **Beaumont Whitton** sends in a very fine and informative letter. It seems that a friend in Charlotte told Beau that **John Longley** had retired from his job with the New York Telephone Company in Albany, where he has worked for many years. And he has packed a trailer and has gone trailer camping and travelling. He stopped in Charlotte last summer, but stayed only one day; while Beau was away. I visited at great length with John last September at the Alumni Officers' Conference. He did mention that he had a trailer and that he had visited with **Dick Fosset** in California via trailer, but he did not mention making any such long and interesting trip, or that he had retired. It would be doing Beau an injustice were I not to quote him from here on (from the letter). "All the Whittons had a delightful summer. We made a trip around the world. Originally we had planned to pick up my eldest daughter who had been teaching in Japan, but she wasn't through visiting so did not come home until the Christmas Holidays. She has now returned to Beirut where she is again teaching. She is sort of working her way around the world. And, Daphne and I plan to come to the 35th Reunion." Beau goes on to say that he talked with "Dot" Huston from the Washington Airport. Dot is our own **Bill Huston**'s wife. Bill has the eldest son in college, with three or four more at home. There are four sons and one daughter. Bill is still

with N. A. S. A. and in one of the very top jobs, I know, and is living as of now in Bowie, Md. . . . When you read this set of facts and fancies, I will have returned from a rather long round trip to Europe. About 100 of you will have received post cards from either Scotland, England, France or Spain. Perhaps even San Juan, Puerto Rico. Very early in February I expect to attend the Great Perth (Scotland) Cattle Show and Sale. This is an outstanding show, and many American breeders attend and purchase cattle at the sale. We at Fort Rock Farm have a herd bull, a son of a Scottish supreme champion. The champion himself would, and did, cost far more than we have to invest. After six days in Scotland I will be in London for a few days, will fly to Paris and will take off the same evening for Madrid, but will find time between planes at Orly, to get in a 3-4 hour sightseeing trip to and around the city of Paris. I have been in Paris many times, but still enjoy those bus rides. In passing I might mention that I have always taken bus rides around all cities to which I made visits. I can recommend this procedure. I will get to Madrid the same day on which I left London, and it is not strange as the distances are short in Europe. After a few more days of sightseeing around and in Madrid, I take off for San Juan, Puerto Rico, and just might see **Bill Pleasants** and **Bill Reed**, or either, from San Juan, then to Miami. The Scottish visit is business and pleasure, and the remainder is all pleasure, that is, all that I can make it as I have to do it alone. Leona is not too fond of flying, and looks with disfavor on these transatlantic flights. I know that I will be forgiven, partially, for writing a little about myself, which is not habitual. The reason is that material is short now and will probably be more bountiful later. I expect, incidentally, 100 odd replies to my postcards from abroad. . . . With an unusual short set of notes for March, I am holding out possibly a page for use in the April Notes, which might also be short, as my Scottish trip starts February 2, and no great excess of material is evident at this moment. So, that's it until next issue.

—**Warren J. Henderson**, Secretary, Fort Rock Farm, Exeter, N.H.

'34

Your new assistant for the Middle Atlantic area is anxious to meet and hear from members in this area. It does not matter to him how you define it. We have a fine alumni club here in Washington D.C., and it is a shame that I do not see people from our class at the meetings. He will soon be sending out letters pleading for notes, news, etc. Don't keep him in suspense. . . . A letter from **Walter Wise** tells about his home life and recreation when he is not busy running as president the Henry G. Thompson Company, a maker of hack saw and band saw blades. His letter should be quoted verbatim in parts. "We recently moved from Orange, Conn., to our new home on Long Island Sound in Milford. We are delighted with

our new location because we have participated in competitive sailing for five or six years, and races from the Milford Yacht Club start almost in front of our property. It is unfortunate that the sailing program at Tech was started after our class graduated because I had to learn with a tiller in one hand and a book in the other. This technique led to some embarrassing mishaps, one of which has made us immortal—we sank the Committee Boat! Our sailing has been done in a 'Thistle' . . . Our competition includes Dennis Posey, who was an outstanding sailor at M.I.T." Wally goes on to tell us that there are three well-grown children; a daughter who received a Master's Degree at Yale and teaches art in one of the area high schools; a second daughter who is studying in Southern France at Aix-en-Provence; and a son who turned out to be a swimmer rather than a gymnast and is a freshman at Rollins College in Winter Park, Fla. The family has been rather Yale oriented, and Wally is Chairman of a Chamber of Commerce committee entitled, "the Yale Industry Committee that is working to develop closer educational ties between Industry and the University. Recently they presented a Seminar which included Ned Bowman formerly of the Institute Staff, but now Controller at Yale." . . .

John Borger writes that he is swamped with SST evaluation and a B-747 (Boeing order) project. The *New York Times* of December 1 on pages one and 29 has some interesting material on the SST which your Assistant Secretary believes was from John. . . . In July I had a short visit from **Arthur Manson** who is at present working on the development of a very unique metal finishing process. . . . We spent a day with John Best of the class of 1935 whom many of you probably know. . . . A colleague of mine at the office recently informed me that **William S. Matthews** is now retired from the Air Force and living and working in San Antonio, the former is confirmed by the local phone book. . . .

Carl Wilson reports that his oldest daughter Susan was married on December 17 to Martin Reich. They both attended Temple University. The wedding date bounced back and forth between the 17th and 24th while everyone anxiously awaited the Army's decision as to when and where the husband-to-be would get his leave. With just a few months notice Muriel managed to get together a pretty fair wedding in spite of the uncertainties. Susan will continue working at *Ski Magazine* as associate art director while the husband (Happy) will commute to Fort Monmouth where his Army assignment will be as a programmer with the Signal Corps. They are now looking forward to the day when he makes P.F.C.

. . . **Yau T. Chiu** in a letter to **Jim Eder** tells us, "We have two sons left in Hong Kong. My third son, Tin-Ho, at last succeeded in getting into Lehigh University to get his master's degree in chemistry. Our fourth son, Tai-Wo, got into Miami University also for his master's in chemistry. Our fifth and sixth sons should have little trouble gaining admission to a U.S.A. university as they are pretty good

students." **Jim Eder** goes on to say that since the first two children got into good American colleges, one becoming a physician practicing in this country, this family rates pretty high on the success-in-college list. . . . The magazine *Metals Review* carries a story about **Frank Milliken**. He was chosen for an ASM Distinguished Life Membership. This honor is "reserved for leaders who have devoted time, knowledge and abilities to the advancement of the metal industry." The article continues, "Mr. Milliken has been president and chief executive officer of Kennecott Copper Corporation since 1961. In 1951, the year before he joined the corporation as vice-president in charge of mining operation, Mr. Milliken's contributions to the minerals industry earned him AIME's Robert H. Richards Award. Last year he received the United States Treasury Department's Distinguished Service Award." —**George G. Bull**, Assistant Secretary-Middle Atlantic, 4961 Allan Rd., Washington, D.C. 20016; **James T. Eder**, 1 Lockwood Rd., Riverside, Conn.; **Norman B. Krim**, 15 Fox Lane, Newton Center, Mass. 02159; **W. Olmstead Wright**, 1003 Howard St., Wheaton, Ill.; **Kendrick H. Lippitt**, 8735 Delgany Ave., Apt. 211, Playa Del Rey, Calif. 90291

'35

Ham Dow's belief that these notes are read by more than the few classmates whose names regularly appear has not been shattered. . . . **Joe Lancor** wrote from Pasadena, Calif.: "Your probe into anonymity has borne fruit. That was an interesting 'gimmick' of yours to provoke some kind of response from people who are normally uncommunicative. In September I enjoyed the wonderful experience of attending the 1966 Alumni Seminar on the 'Biological Bases of Learning.' The growth of the Institute and the intellectual level of their current undertakings was certainly exciting and gave one a feeling of great pride to be associated. As a matter of fact, during the past few years my work does get me back to the Institute two or three times a year. I just recently learned that I have spent 15 years in my current location and endeavors. Time does move on. In the span of 30 odd years since leaving the Institute, I have struggled successively with aircraft instruments, radar fire control, ground to air missiles and scientific instruments. Over these years a great deal of airline time has been logged. Last year, having become disenchanted with the available entertainment in flight, I decided to take a flyer in that field. You will see the results this spring on American Airlines' flight of 707's. To you, may I say, that I have long admired men who will undertake the duties of class Secretary so that his classmates, even the silent ones, may have the occasional pleasure of reading an old familiar name." Joe is with Bell & Howell, Vice-president, Special Product Development. . . . **Cason Rucker** wrote from White Plains, N.Y.: "As one of the fallen, I cannot agree with the remarks of



PHOTO: D. MICHAELS FROM *Scientific American*
George S. Schairer, '35, vice-president, research and development, for the Boeing Company ("Why should he care about Frozen Tombs of The Scythians?") is the second M.I.T. alumnus to be featured in *Scientific American*'s "new industrial management" advertising series in the *New York Times*. The first was Harold W. Fisher, '27, whose *Scientific American* picture was in *Technology Review* for January; and a third ad has featured Albert G. Hill, M.I.T. professor of physics. The series—in which M.I.T. is batting three out of eight—"dramatizes the ascendancy in management of men with an engineering or scientific education," according to Stephen M. Fischer, assistant to the publisher of *Scientific American*.

other 'fallen brothers.' My name is neither Stockmayer, Colby, Mowatt or Bemis, but I am one of the 50% who enjoy reading of them. Without their fertile efforts the anti-barren seeds would never have been planted—and what for a column? Some years ago, as editor for an in-house newspaper, I learned that participation is pretty important, so I'll try to do my part. Our rambunctious friend Lewis D. Gilbert would say enough of the accolades for S.C.M.B. et al—let's get on with the meeting. My marketing and consulting life is continuing one step after another. The lighthouse seems to be growing taller day after day, with more steps to be climbed. It's fascinating, each one seems to fall naturally into place after the previous step. Am about to undertake a new specific assignment and am most enthusiastic about the potentialities. Along the way, Kay and I have raised what we consider three fine kids, now 23, 21, 19. Have a bushel of notes for 'that novel,' 'those articles,' and 'the comic strip.' Will write again but had to rise to your defense." Well, if two or three of you hidden (or hiding?) 50% of the class will write each month, we'll have this column full of goodies and we'll promise to discontinue harassing tactics. But if you don't—wow! From here and there: John

T. Howard, who is a professor at The Institute in the Department of City and Regional Planning, is a member of the blue-ribbon advisory panel which will help San Francisco select a new city planning chief. . . . **Chet Bond**'s daughter Ellen, who will graduate from Lasell College this June, is engaged to Joseph Anthony Kane son of Joseph Kane, '32. . . . **Howard Beck** recently purchased a beautiful old farm near Manchester, Vt., and spends most weekends there, with particular emphasis on skiing. . . . **Gerry Golden** who is now the proud holder of the class cup for the "Father of the Youngest Child" (the only athletic trophy he has ever won he claims), is so delighted and encouraged by it that he now challenges all classmates to a two-mile foot race, for which he will provide a trophy to the winner. For particulars write to Gerry at 3 Hammondswood Rd., Chestnut Hill, Mass. 02167. When writing to Gerry make your letter class notes "newsy"; he'll turn such letters over to your class Secretary, who advises that no one should enter this running contest who is not in tip-top shape and who has not run this distance recently in less than 13 minutes. 1967 Class Golf Tourney news: will the following please write to **Allan Mowatt**, telling him their new addresses so that they may be properly entered: **Henry Ogorzaly**, **Paul Gilmont**, **Ned Collins**, **Bud Pflanz** and **Don Wood**. In doing so, why not write letters that will be interesting reading, also, in these class notes.—**Irving S. Banquer**, Co-secretary, 20 Gordon Rd., Waban, Mass. 02168

'36

The holiday season brought greetings from **Gerry McMahon** and his family in Lake Charles, La., and from Ruth and **Hank Lippitt**, ostensibly from Los Angeles but also from the summit of Mt. Whitney, the bottom of the Grand Canyon and from Lausanne, Switzerland, to mention only a part. Those Lippitts really get around. . . . During the Christmas holidays George and I attended a farewell party for **Bernard Vonnegut** who is forsaking Arthur D. Little's unhallowed halls for those hallowed ones of the State University of New York at Albany where he will be associated with the Atmospheric Sciences Research Center and doing some teaching. . . . As nearly as I can ascertain this leaves **Dick Robinson** and **Ben Fogler** carrying the '36 banner at Acorn Park with my George a class member by marriage. . . . Address changes include that of **Bill Abbott** to 134 Wenonah Road, Longmeadow, Mass. 01106; **Everett Cargen** to 9408 Sage Avenue, Riverside, Calif. 92503; and **Mrs. Llewellyn R. Perkins** to 407 East Kingsley, Apt. 5, Ann Arbor, Mich. 48104. In January I reported a new address in New Jersey for **Fred Prah** but my letter to him there was returned to sender labelled "addressee unknown." The Alumni Office is checking on it.—**Alice H. Kimball**, Secretary, 20 Everett Avenue, Winchester, Mass. 01890

'37 CLASS REUNION June 9, 10, and 11

Al Busch, who is president of Keuffel & Esser Company, made the keynote address to the delegates attending the 1966 Visual Communications Congress. He proposed a public-private U.S. technical information storage and retrieval network patterned after the Federal Reserve System to avoid wasting an estimated \$2 billion annually on research and development work connected with incomplete technical information. K&E, which celebrates its 100th anniversary in 1967, is the world's foremost supplier of working tools for the engineer, draftsman and architect, as well as the engineering educator and student. . . . Professor **Leo Moore** spoke at the New England Shoe and Leather Association Industrial Management Session on "NESLA'S Management Research Program." His talk was received by acclaim by the shoemen present. . . . **Walt Sherry**, who is a partner in the consulting engineering firm of Sherry and Lysiak is an instructor in the examination review classes for the Professional Engineer Review Course sponsored by the New York State Society of Professional Engineers. He has been teaching these classes for 15 years. . . . Remember the dates—June 9 through June 12. Place—Oyster Harbors Club. What's happening—Our 30th Reunion!—**Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, Mass. 02155; Professor **Curtiss Powell**, Assistant Secretary, Rm 5-325, M.I.T., Cambridge, Mass. 02142; **Jerome Salny**, Assistant Secretary, Egbert Hill, Morristown, N.J.

'38

Promotions are the tenor of spring, and while those we report here did indeed take place some time ago, any story worth telling is a pleasure the first time you hear it—and it doesn't do too badly the second and fifth time around! **Arnie Kaulakis** in a long career with Esso has been appointed assistant to the refining coordinator of Standard Oil Company (N.J.). Since 1961 he has been a vice-president and director of Esso Engineering, first engineering vice-president and then vice-president responsible for corporate services. In his round of experiences, Arnie was manager of employee relations for two years, and has published a number of management-oriented papers. Continuing in the petroleum business, **Dave Reid**, who took his S.M. with us in Course X, joined Socony Mobil in 1961 and has now been named senior engineer in Socony Mobil Oil Company's engineering department. . . . **Bob Campbell**, as Confidential Vice-president of the class of 1938 and therefore of a taciturn sort, is appointed to a newly-created post in The MITRE Corporation—and we hear about it from the Review clippings! Director of program planning in the Office of the vice-president for technical operations is the title and job

created for Bob, after 17 years with the Burroughs Corporation. Asked to aid in identifying goals and objectives, "He has been charged with producing and maintaining a MITRE program plan covering at least five years of future operation." At Burroughs Bob was director of technical planning, and previously director of research, with a personal specialization in research and development on computers and data processing systems. . . .

Arch Copeland has been appointed manager, Detroit Division Sales Office, of Revere Copper and Brass Inc. Long established in Detroit, Arch became technical advisor in 1951 and continued in that position until this appointment as manager. . . . Personal mail this month is unusually rewarding, with the following tidbits: **Dick Vincens** reports, "I have been with Sunbeam Corporation in Chicago for the last two years, directing operations of its manufacturing plants in the U.S. Also elected president of its Forest Industries subsidiary. Last year I had the honor of being president of the American Production and Inventory Control Society." I can testify Dick has been moving around enough so there is a 50% chance any mail you send to him will be returned "unknown at this address"! . . .

Al Wagner adds another page to a colorful aviation career with the note, "Have been employed by the Boeing Company since July 1965." Previously Al got the bug when he started with Lockheed in 1951, and since then has worked with Douglas, North American, and Lockheed-California. "At Boeing," Al reports, "I am a 'service Engineer A' with the Commercial Publications Department, enjoying very much the company, the work, and the living in this section of the country". . . .

Gordon Butler, who received his Sc.D. with us in '38, provides the following: "I have purchased Metallurgical Service Laboratories in Santa Fe Springs, Calif. We perform chemical analyses, physical tests, metallographic services, experimental stress-strain analyses, and provide metallurgical consulting services. . . .

Bob Solomon (with an M.D. from Johns Hopkins) has been working at the City of Hope Medical Center in Southern California. "For the past six years I have been studying arteriosclerosis as a Research Pathologist—a subject important at our age! Excitedly we have had some success in reversing the experimental disease in animals!" . . . "Hope to get back for next class reunion," says **Jack Crichton**, in the timely remark of the month! Have you planned your sabbatical, the graduations of your children, and your wife's second (or tenth) honeymoon so that you can be in Cambridge June 7-10, 1968? How about writing two others to encourage them to join you? Jack's memo says, "Getting back into normal business operations after having been the Republican candidate for Governor of Texas in the '64 debacle. I have an oil and gas consulting firm, Crichton and Company, specializing in petroleum finance, foreign oil situations, and natural gas." See you in '68, Jack, and all the rest of you-all!—**Frederick J. Kolb, Jr.**, 211 Oakridge Drive, Rochester, N.Y. 14617

'39

An unusual and thoughtful Christmas card from Betsy and **Bob Withington** (Holden W.), XVI, of Seattle featured photos of their four skiing children in racing helmets and goggles: Vincent, Tori, Martin, and Holden. Seven verses recounted the family's winter recreation, concluding with the following: "We won't wish you a year of no blizzards, For we know you enjoy a good fight, But may your gloves be warm, your equipment strong, and soft snow your frequent delight." Bob's card didn't include his present position, but my last record, from the '61 Alumni Register, indicates that he is director of engineering, Aero-Space Division, of Boeing. . . . **Frederick B. Grant**, XV, wrote at Christmas also. He and Ginny took a golf tour through the Carolinas in October, and visited **Robert J. Saunders**, also XV. Bob and Sibyl live in Southern Pines, N.C., where Bob is president of Morgan Carpet Mills. He built the mill and got it into production in 1965, and is now traveling extensively to expand his distribution. . . . A card from **Nicholas E. Carr, Jr.**, X, gave his current home address as 320 MacArthur Drive, Orwigsburg, Pa. 17861. Again from the Register, Nick's position is general manager of Avisun Corporation, Marcus Hook, Pa. . . . The welcomed annual letter from **Frederick A. F. Cooke**, XV, gave further details of his recent move to Belgium (December '66 Notes) as general manager of Frederic R. Harris (Belgium) S.A., Consulting Engineers. I'll send a copy of Fred and Eugenia's full-page letter to any classmate who wishes news of them plus the family: Kathleen, Lucy, Gina, Laurie, and Freddy. Or write to the Cookes at Casa Erica, 41 Avenue de la Corniche, La Hulpe, Belgium. Fred postscripted the family Christmas letter: "Taking over Harris' Belgian operations and learning the fine points of conducting an engineering practice in this international community has been an added challenge. I'm fully absorbed with my new job. We are involved with a number of most interesting engineering projects including an urban expressway and semi-metro in Antwerp, highways in Southern Belgium, and a variety of industrial developments. Then there are many prospective assignments involving a broad range of facilities from ports to family housing." . . . A clipping from *IEEE Transactions Education*, September 1966, described Dr. **Lloyd P. Hunter**'s, VIII, present and recent assignments. Formerly with IBM at Poughkeepsie, as director of component engineering, active in solid state electronics research

Arch H.
Copeland, Jr., '38



and development involving semiconductors, magnetics, and cryogenics, Lloyd spent the 1962 academic year at Stanford University as visiting professor of electrical engineering. In 1963 he became professor of electrical engineering at the University of Rochester, in Rochester, N.Y. He is a Fellow of the American Physical Society and a member of at least six honorary and technical societies, and as well, finds time for writing and editing.

Two death notices are to be reported this month. Mrs. Frances M. Girardi wrote that her husband, **Alexander Robert Girardi**, XV, suffered a severe heart attack and died on Saturday, November 19, 1966. No other details. In the '61 Register he was listed as being with Johns Manville, in the New York City headquarters. . . . This belated item is that Dr. **Thomas H. McConica**, 3rd, X, passed on September 25, 1960. His address at the time was the American Ski Company, Clare, Mich.—**Oswald Stewart**, Secretary, 3395 Green Meadow Circle, Bethlehem, Pa. 18017

'40

Louis Michelson, long time with General Electric, is now president of Spacerays, Inc., Burlington, Mass. On the occasion of his change in position, he sent your Secretary the following note: "It seems to me I owe you a letter for a long time to bring you up to date on my activities. For the past 11 years I have been with the General Electric Company. The first five years were spent in Cincinnati as manager of rocket engines and the last six years in Philadelphia as manager of space environment simulation, then manager of NIMBUS Weather Satellite Project, then manager of all NASA programs, and last as manager of marketing and advanced requirements in the Missile and Space Division. In July of 1966 I resigned from General Electric to accept the position as president of Spacerays. Spacerays is a company devoted to the development and manufacture of lasers—ruby and gas. We've just moved into a new building in Northwest Industrial Park in Burlington and I am reestablishing my acquaintance with some of my fellow alumni at M.I.T. Floss and I are renting a house in Lexington for the time being. Our daughter, Barbara, is 23 and works for an advertising agency in New York City." . . .

Leonard Weaver is now development manager for the Building Materials Division of Bird & Son, Inc., in East Walpole, Mass. He has been with Bird & Son since June 1941, and also is the founder and director of the Neponset Choral Society. . . . That's the news in brief for this month; your letters are welcomed!—**Alvin Guttag**, Secretary, Cushman, Darby & Cushman, American Security Building, Washington, D.C. 20005

'41

J. Cranston Gray has become associated with Canton Textile Mills of Canton, Ga., as vice-president of operations. In this ca-

pacity he will be in charge of manufacturing, research and engineering. He assumed this position on January 1, 1967. Since June of 1965 he has been in charge of several plants of the Bibb Manufacturing Company in Porterdale, Ga. Prior to his association with Bibb he was vice-president of manufacturing for Berkshire-Hathaway, Inc., in New Bedford, Mass., followed by a brief period of practice as a consultant. . . . **John E. Bone** has left the First Atomic Ship Transport Inc. to return to the parent company, American Export Isbrandtsen Lines, as manager of new construction, planning and plans approval. He had since 1963 guided the nuclear ship "Savannah Project" while with Atomic Ship Transport, Inc. which operates the Savannah for American Export Isbrandtsen Lines. John joined Isbrandtsen in 1947 after two years with the Bethlehem Steel Company's Fore River Shipyard at Quincy, Mass., and three years in the U.S. Marine Corps. . . . **Herbert E. Hirschland**, group vice-president in charge of research and development for M & T Chemicals, Inc. of New York City, is now also administering M & T's marketing division operations. He is also a director and member of the executive advisory committee of M & T, a wholly owned subsidiary of American Can Company. M & T is a supplier of organic and inorganic chemicals, metal finishing processes and special chemicals for the ceramics industry. . . . The M.I.T. Club of Mexico City wishes to inform you that the 19th Annual M.I.T. Fiesta in Mexico will take place in Mexico City March 9-11, 1967, with many delightful

activities planned. For reservations write or call: Armando Santacruz B., M.I.T. Club of Mexico City, Reforma 116-804, Mexico 6, D.F. . . . Please note that we would like to see more articles from you fellows concerning your activities. Mail them to any of the following for inclusion in this column.—**Walter J. Kreske**, Secretary, 53 State Street, Boston, Mass.; **Everett R. Ackerson**, Assistant Secretary, 16 Vernon Street, South Braintree, Mass.; **Michael Driscoll**, Assistant Secretary, City Hall, Nantucket, Mass.

'42 25th CLASS REUNION June 9, 10, 11, and 12

Lou Rosenblum who has been working extremely hard on the reunion sent me the following plea which I am repeating in its entirety: "During the past eight months we have circulated three complete mailings to our class. In due course we have learned to our chagrin that a significant number of addresses were not current and were so old that mail was not forwarded by the post offices. Through assiduous follow-ups we have tracked down all of you who are reading this column and many others in addition. There are however 18 men and women of the class of 1942 who have disappeared. If any of the readers of this column know the whereabouts of the following, please invite them to our reunion in Cambridge on the Institute campus from Friday, June 9, to Monday, June 12, 1967. If you can write us with one or more current addresses, so much the better. The traceless ones are as follows: Colonel **Ralph L. Clary**, Mr. **Robert R. Close**, Dr. **Belmont G. Farley**, Mrs. **Lisa M. Finney**, Mr. **John F. Gallagher**, Mr. **William E. Hense, Jr.**, Mr. **Gordon H. Hill**, Lt. **William J. Kotsch**, Major **William L. Molo**, Major **Roger H. Olson**, Mr. **Warren H. Powers**, Mrs. **Orland B. Reynolds**, Mr. **T. W. Gilmer Richardson**, Mr. **Charles B. Smith**, Dr. **Marvin N. Stein**, Dr. **Edward P. Todd**, Mr. **James C. Turnbull**, Mr. **C. F. B. Wilding-White**." . . . It is my unhappy duty to report that **Henry E. McLaughlin** died more than a year and a half ago. I received this information from the Alumni Records Office, but I have no details. If anyone has any information, I will be glad to print it here.—**John W. Sheetz**, Secretary, 45 Rutledge Rd., Belmont, Mass. 02178

'43

John Peterson has been elected an executive vice-president of Drew Chemical Corporation. His responsibilities encompass the refinery operations of the Drew Foods divisions and the sale of such vegetable oil based products as margarines, shortenings and specialty fats to the bakery, candy and confectionery and allied food fields. John joined Drew in 1960. In 1964 he became president of the firm's St. Louis refinery, Drew Foods Corporation. He continues to serve in this capacity in addition to his duties as corporate executive vice-president. . . . **Bailey**

Nieder has been appointed marketing director for the Carling Brewing Company's Cleveland-based Central Division. Formerly Carling corporate director of planning, he became associated with the brewing industry in 1948 when he joined Heidelberg Brewing Company at its Tacoma plant. He was plant manager when Carling acquired the plant in 1959 and remained as assistant to the vice-president and general manager. In 1962 he joined the staff of Canadian Breweries Limited, parent company of Carling with headquarters in Toronto, Canada. He was appointed executive assistant to the president of Canadian Breweries in 1964 and was transferred to Cleveland in 1965. He served briefly as marketing coordinator for the eight-state Central Division prior to being appointed director of planning. He holds a certificate in brewing science from the United States Brewers Academy in Mt. Vernon, N.Y., and is a member of the Association of Professional Engineers and the Master Brewers Association of America. Many of us remember Bailey's generous gift of Carling's Black Label beer at our 20th Reunion. . . . **Fred A. Mudgett** was elected a vice-president of Hertz Corporation and general manager of Hertz International, Ltd. He joined the car and truck rental concern in 1946 and in 1962 was elected a vice-president of Hertz International, the foreign rental and leasing subsidiary. A graduate of Knox College, he received his master's degree with our class. . . . A meeting of the 25th Reunion Gift Committee was held on December 1st in Boston. Present were Chairman **Ned Swanberg**, **Jim Hoey**, **Gene Eisenbeg**, **Leo Feuer**, **Stan Paterson**, **Ken Warden** and **Jim McDonough**. It was reported that we have reached the one-third mark of our goal of \$400,000 and that the prospects are extremely good for substantial contributions during the next 15 months. . . . Your Secretary and his wife were in San Juan, Puerto Rico, in December where we again enjoyed the gracious hospitality of classmates **Tony DelValle** and **Angel Gonzalez**. Tony is president of Rodriguez and DelValle, Inc., engineers, contractors and developers. He and Carmen have succumbed to the boating bug and spend most of their weekends cruising the Caribbean waters in their 42-foot yacht. Angel has his own consulting engineering firm in building engineering and construction, specializing as a owner's representative for major building projects.—**Richard M. Feingold**, Secretary, Ritter & Berman, 266 Pearl Street, Hartford, Conn., 06103

'44

I was very pleased, in fact thankful, to receive the annual Christmas card and letter from **Richard J. Kulda** and his wife, Mary Ellen, of Orange, Calif. The letter starts, "Well, here it is December 26th again and time to write Christmas cards. It is a beautiful day: visibility unlimited, temperature about 70 degrees, sun shining from spotless skies, and the usual light southwest breeze." (The body of the letter is printed below.) Earlier I had received

PLAN AHEAD for your CLASS REUNION!!

Mark these dates down
on your calendar

June 9 10 11

AND

Alumni Day June 12

- Renew old friendships
- Relax and enjoy a wonderful week-end
- Then come back to the campus and witness the many changes, see, meet and talk with the faculty and listen to the dynamic seminars on Alumni Day

MAKE YOUR RESERVATIONS NOW

... Full details are on the way

cards (and notes) from **Ed Cochran** and wife Jane of Hagerstown, Md., and from **Robert Veitch** and wife Pearl of Huntington, N.Y. Jane Cochran says, "All our children are teen-agers and in four years they will all be gone from home. Makes us feel sad and quite aged." Bob Veitch says, apparently after seeing the November notes, "Pretty soon it will be the Robinson Review if you run many more columns in the Class Notes section." Bob, as you will have seen by the time these notes appear, the November issue was the exception. Unfortunately, we're back to the more typical situation, namely, a thin supply of news. The December issue of the Review carried a suggestion that classmates keep each other in mind when exchanging Christmas cards. My copy of the magazine reached me only three days before Christmas. It did not seem to have any effect even on those who normally send their cards after Christmas. **Jack Barmby** told me today, January 11, that he is working on his cards—he and Ellaveen are wishing people happy Easter. Jack also told me he is working with Larry Conant, '21, in arranging for a seminar scheduled by the Washington, D.C., Club for February 18. . . . We are down to one clipping this month: The Harvard Business School announced in a press release dated December 1 that **Andrew F. Corry, Jr.**, West Newton, Mass., would be graduated December 9 from the Advanced Management Program (AMP) as a member of the "golden" 50th AMP class. That's it for this month. Does everybody understand that news in any form is welcomed all year long?

Let's turn back to the interesting letter from the Kulda's which continues the story begun in the July notes: "Dick ran for the office of County Supervisor, an office of some importance here in the West where a county is more than merely an area of court jurisdiction. The Supervisors run the County the way the City and Town Councils run the municipalities back East. Dick missed coming in second (out of a field of five contestants) by a little over 600 votes, and thus was spared a runoff with the incumbent who failed to make a majority the first time around. We got a lot of notoriety as a result of headlines and front page articles concerning our Court administered recount and Grand Jury investigation. The kids, of course, thoroughly enjoyed the notoriety in school. Mom and Dad, though, almost failed to survive the rigors of campaigning. There isn't any more wearying work. But we found compensation in all the wonderful people we met. We discovered that there are no finer people anywhere than the rank and filers in politics (Republicans, that is). With rare exceptions they are intelligent, selfless, patriotic, cheerful, committed, and delightful to be around. A social gathering among them makes all other parties as dull and as tame as an evening with the Mouseketeers . . . Dick had one other thrill. He has an altar choir of all men that sing nothing but chant. He was invited to bring his choir to the seminary to show the seminarians how Gregorian chant should be sung. After hearing that news he floated into the house six feet in the

Richard J.
Kulda, '44



air. . . . We end the year having rid the house of about 10 wild mice but owning about 20 white ones. Susi, 7, killed one wild mouse by falling on it and crushing it with her stomach. Greg's white rat killed another. Dad killed a third by swatting it with a newspaper. Mary Ellen sacrificed a meal for each of the departed ones. She didn't feel it necessary to so deprive herself for the remainder which died by more conventional means. We still have a menagerie of hamsters, dogs, rabbits, etc." Thanks, Dick. I am sending your campaign brochure with the pictures of Richard J. Kulda as statesman, administrator, civic leader, educator, engineer, and last but not least family man with seven children to the Review editor. . . . Maybe by next month we'll have Christmas letters or some kind of letters from other members of the class—**Paul M. Robinson, Jr.**, Secretary, Navy Department Program Information Center, Pentagon 4D683, Washington, D.C. 20350, 202-695-0351 or 7710 Jansen Dr., Springfield, Va. 22150; Assistant Secretaries: **Paul M. Heilman, 2d**, Copper Development Association, 405 Lexington Ave., N.Y., N.Y. 10017, 212-867-6500 or 30 Ellery Lane, Westport, Conn. 06880, 203-227-3469; and **John G. Barmby**, IIT Research Institute, 1200 17th St., N.W., Washington, D.C. 20036, 202-296-1610

'45

Flash! **Tom McNamara**, our off-year Reunion Chairman, advises that some 30 to 40 will be enjoying the Bermuda sunshine the end of April. It is difficult—to say the least—to visualize or project four months ahead but we shall try! As of today, January 7, Tom reports that the Reunionees will be at Harmony Hall in Paget, Bermuda, for about five days commencing Friday, April 28, or Sunday, April 30. No formal program—just rest and relaxation.

Richard Kulda and his family during the recent campaign for County Supervisor, Orange County, California.



Fortunately, Harmony Hall has excellent beach facilities and guest privileges at the Belmont Country Club, one of Bermuda's finest links. Of equal importance it is centrally located; i.e. 15-20 minutes to downtown Hamilton by either boat or motor bike. Ironically, Fran and I spent a week at Harmony Hall in '62; no, we had nothing to do with this McNamara choice. At this moment **Bill Meade**, our Treasurer, has deposits from **Lally** and **Jerry Quinnan**, Barbara and Cdr. **Sam Moore**, Janet and **Charlie Patterson**, Trudy and **Max Ruehrmund**, Charlotte and **Walt Nason**, Elaine and **Bill Shuman** plus family, Rosemary and **Nick Mumford**, Louise and **Tom McNamara**, and Ann and **Bob Maglathlin**. Nick Mumford's Christmas card indicated that **Libby** and **Harry Eisenhardt** would be joining while the **Guy Gillelands**, **Al Bowens**, Bill Meade and ourselves hope to attend. Should any of you (or for that matter all of you) feel that you would like to join the happy throng at this late date or even later, I would suggest you call Tom McNamara, (617-479-4949) who will assist you and your travel agent in making last-minute arrangements at Harmony Hall, the Belmont, or Bermudiana which all operate under common management. It should be a great time—one you do not want to miss. . . . In his efforts to make reunion funds, Tom McNamara tackled a do-it-yourself project the weekend before Christmas all to no avail. A missed backward step caused Tom to wind up in the hospital for a two-week stay—phlebitis, blood clots, and vein removal all in the right leg. By the time you read these notes, Tom should be fully recovered, although at the moment he is still laid up and away from Honeywell's shop in Waltham. Nick Mumford reports that he has heard from **Jake Freiberger** that he, Jake, is slowly recovering from a heart attack that felled him in early September. We all wish you a hasty and successful recovery, Jake.

Fran and I have had a good fall with 45! Nick and Rosemary Mumford spent a night with us in mid-September as they returned from leaving Nicky in Cambridge the prior weekend. As you might suspect, Nicky left home and started Tech as he entered the clutches of fraternity rush headquarters in the new Student Center. While we dined Tuesday evening, Nicky called to indicate he had pledged Sigma Chi, which, in turn, prompted Nick and me to call Jake Freiberger in Dallas, collect of course, to tell him the news. I might add, parenthetically, that the senior Mumford was a bit miffed when he learned that his son had not bothered to visit his father's fraternity. The day following the Mumford visit was long—not only for the host but also Nick himself who sat up until 3:00 A.M. the following morning talking with Lou and **Pete Hickey** in Moorestown, N.J. Some several Saturday evenings later we received a long-distance call from **Vince Butler** who was visiting **Buzz Busby** in Jackson, Miss. It seems Vince was returning to California from two-weeks active Navy duty in Florida. Vince had to tell us how difficult it was for Buzz to find his home—not, however, for the rea-

sons you might suspect. The Busby family had moved from Corpus Christi to Jackson while Buzz was out in the oil fields, and he just didn't know where he lived. Vince's Christmas card which was a cute picture of the Butler children, raved about his Jackson weekend even to the beauties of the jet age; i.e. dinner in Jackson, in flight, and again in San Francisco.

The weekend of November 5 found Lib and **Jerry Patterson** and Lou and **Pete Hickey** joining Ellen and **Jim Brayton** and ourselves at West Point for an Army game. The football wasn't the best, but a good time was had by all. After the game Billie and **Al Bowen** joined us here in Stamford for dinner and an evening of chatter. We don't know whether it was the fresh air, old age, old-fashioned common sense, or senility, but by midnight we were all fast asleep! . . . As always Fran and I fully enjoy the Christmas greetings we receive from our Institute friends; unfortunately, neither time nor space permits us to share them all with you. To fully appreciate the **George Bickford**'s picture you must remember our sons hair style—long. Next you must have father, George, stand alongside Betty, Susan, Palma, and hairy Robert to complete the portrait! We are all a bit jealous, Curly. . . . **Chick Street**'s block print ocean cruising vessel was most appropriate for the sailing Street family. . . . Mt. Holystone Lisa along with Janet and the twins, Pete and Biff, are always a welcomed relief on the Hickey card. . . . **J. J. Strnad**'s card had several fold-out pictures portraying the family in action—Edna at the tennis courts, the girls, Lyse and Nina, in their riding habits, young James in his football uniform, and J. J., not with a glass, but a rifle in hand preparing for skeet shooting! . . . The **Sherry Ing** family all in colorful Hawaiian attire was some contrast to our cold white New England Christmas. Again, thanks to you all for your friendly greetings. . . . Attention **Jim Hoaglund**—what are you doing? Some time ago we reported that you were with Bell and Gossett in the Chicago area, and now the Institute indicates you have come East to Jenkintown, Pa. What goes? See you all next month.—**C. H. Springer**, Secretary, c/o Firemen's Mutual Insurance Company, 420 Lexington Avenue, New York, N.Y. 10017

'47 CLASS REUNION

June 9, 10, and 11

By the time this issue goes to press you should have your first mailing on the 20th Reunion which is going to be held at the Waterville Valley Inn, N.H. Although I do not have many details as yet, I understand that this is a beautiful area with all the facilities necessary to overstress tired muscles. More details will follow as soon as they are available. . . . Back to your classmates. **H. T. Robson** is plant technical director at Union Camp Corporation in Montgomery, Ala. . . . **John J. Flynn, Jr.**, has been promoted to plant manager and chief plant engineer of Winthrop Laboratories, Division of Sterling Drug, Inc. . . . **William H. Brett**



John J.
Flynn, Jr., '47

has been appointed a vice-president at the Washington, D.C., office of Booz, Allen, & Hamilton, Inc. . . . Dr. **Edward H. Bowman**, comptroller of Yale University, has been elected a director of the Dictaphone Corporation. Dr. Bowman was previously special assistant to the president of the EDP Division of Honeywell Corporation. Ed is a native of Watertown, Mass., and now resides in Woodbridge, Conn., with his wife and two children. . . . Dr. **Norm Holland** is new chairman and professor of English at State University of Buffalo. I understand his forthcoming book is called, *The Dynamics of Literary Response*. M.I.T. will miss Norm and his many innovations in teaching. . . . **John U. Allen** is director of urban development for Cincinnati. . . . **Robert L. Connors** has been named vice-president, manufacturing, for the Native Laces and Textiles division of Indian Head, Inc. Bob lives in Saratoga Springs, N.Y., and has five children. . . . In the next issue I will report on the response to a recent request for class dues, comments from classmates, and other bits of interest.—**Martin Phillips**, Secretary, 41 Avalon Road, Waban, Mass. 02168

'48

The class of '48 spring dinner will be held April 12—cocktails 6:15, dinner 7:15, M.I.T. Faculty Club. Come hear **Peter Richardson**, Associate Director of Admissions at M.I.T., "Getting Johnny into College." Wives are invited. Join us. For reservations write to **Sonny Monosson**, 333 Washington Street, Boston, or phone him at (617) 523-0035.—**Kenneth S. Brock**, Director Alumni Fund, M.I.T., Cambridge, Mass. 02139

'49

The mail this month was particularly nice because two of the lads had gone to the trouble to send me direct personal news,



Edward H.
Bowman, '47

and the first four names were those of men I clearly remember after these 18 years. **Walter Seibert** has been working in Mexico for 11 years and is now manager of operations for Union Minera Del Sur, S.A. de C.V. which is affiliated with the Cities Service Company and the Tennessee Corporation in a big sulphur exploration program and other mining interests. Walter lives with his wife and six children in Mexico City where the children entered English speaking schools for the first time! Walt highly recommends Mexico for an excellent but moderately-priced vacation. Give him a ring at 12-80-03 (office) or 45-82-02 (home) for free tourist trips. (Note by Secretary: This gives me a chance to mention that, judging by all I hear, the boys in Mexico City run a terrific M.I.T. Club, and their annual fiesta which we have mentioned before is very much worth going to.) . . . I was most pleased to get a note from **E. Vernon Dougherty** who writes: "This past August I was appointed manager of planning for the Industrial Division of Honeywell, Inc., in Fort Washington, Pa. I have been with Honeywell for 12 years starting as an application engineer, then a senior staff engineer for planning. My wife, Barbara, two-year-old daughter, Marjorie, and our miniature poodle, Pierre, are just about to move to our new home in Haverford, Pa. (at 10 Meadows Lane). . . .

Sid Howell has joined the Cummins Engine Company as vice-president for automotive sales. Sid will direct marketing operations aimed at primary suppliers of trucks, buses, and other highway equipment. Prior to his present assignment, Sid was vice-president, sales and marketing, of the Weatherhead Corporation of Cleveland. Sid was a fighter pilot for three years which seems to be the closest he ever came to using his aeronautical engineering degree. Also he is a member of the Society of Automotive Engineers, the Sales-Marketing Executives International, and the Institute of Aerospace Sciences. . . . A thumbnail sketch in the *IEEE Transactions* bring us up-to-date on **Dave Stallard**. After getting his master's degree from Tech in 1950, Dave worked for Westinghouse in Pittsburgh and Baltimore from August 1950 to March 1953 and then at the M.I.T. Servomechanism Laboratory until July 1956. He joined Feedback Controls, Inc., in Waltham and Natick, Mass., until 1960. In the summer of 1961 he was a consultant on ship stabilization at Vosper, Ltd., Portsmouth, England. Finally, in July 1962 he joined Raytheon's Missile Systems Division, Bedford, Mass., as a principal engineer where he has worked on analysis of missile guidance, autopilot design, and related control problems. Dave is a member of Tau Beta Pi and Eta Kappa Nu. . . . The information explosion about which we keep hearing will be well on its way to being tamed when someone figures out how to cut down the output of Dr. **Benjamin Lax** of the National Magnet Laboratory at M.I.T. First, in *Science News* we read that, "An expert on the semiconductors that are widely used in such devices as transistor radios and hearing aids was one of the seven scientists awarded a patent

for obtaining laser action for semiconductors. The expert is Dr. Benjamin Lax of M.I.T. to which rights to patent 3,258,718 were assigned. With his six co-workers Dr. Lax found a way to use gallium arsenide, a semiconducting material, to make a laser that operates in the infrared region of the electromagnetic spectrum." Next in *Proceedings of the IEEE* we note a talk or paper which Dr. Lax gave on "Research with Lasers" in April. In *Physical Review Letters* for October 24, 1966, Dr. Lax is co-author of a paper on "Nonlinear Magneto-Optics of Landau Electrons" and in the November 7 issue of the same publication is co-author of a paper titled "Multiphoton Magneto-Optical Resonance in PbTe and InSb." These last two papers are completely out of my field and leave me dizzy but impressed. I'm sure they are valuable contributions to knowledge.—**Fletcher Eaton**, Secretary, 42 Perry Drive, Needham, Mass. 02192

'50

Here it is well into 1967, and I'm still catching up on your 1966 life. I'm glad to see the class of '50 popping up all over the place. Dr. **Roger Manasse** is supervisor of the Radar Technology Department of MITRE Corporation. Roger received his Ph.D. in theoretical physics from Tech in 1955. From 1950 to 1952 Roger was with the M.I.T. Instrumentation Laboratory working on research, development and testing of gyroscopes and accelerometers for inertial navigation systems. Then from '54 to '59 he was a staff member of M.I.T.'s Lincoln Lab where he was primarily involved with the application of decision and measurement theory to the analysis and design of radar systems. Roger joined MITRE in 1959 and in 1960 was named associate head of the Radar Systems and Techniques Department, and in 1964 was made head of the department. Roger is living in Westford, Mass., with his wife and two children. . . . I noticed that **D. Rose** recently co-authored an article in the *Journal of Applied Physics* entitled "Plasma Diagnostics Using Lasers: Relations between Scattered Spectrum and Electron-Velocity Distribution." The research was principally supported by the U.S. Atomic Energy Commission and was done at M.I.T.'s Department of Nuclear Engineering and Research Laboratory of Electronics. . . . **Nathan Cook** is back at Tech as a professor of mechanical engineering. Nat recently wrote a book entitled *Manufacturing Analysis* published by Addison-Wesley. The book provides the background analysis required to understand manufacturing operations and to predict manufacturing behavior. Nat covers such areas as material behavior, metal cutting, metal forming, new and unconventional cutting and forming techniques, machine tool vibrations, and manufacturing cost optimization. . . . **Walter Kunze** is in Chicago where he is midwestern-regional manager of the Portland Cement Association. Walter served as director of promotion planning and engineering services for the association since '64. He joined

PCA in '52 as a structural engineer, became assistant manager of the Structural & Railways Bureau in 1958, manager of personnel training in 1959 and manager of the Structural & Railways Bureau in 1960. Walter is a Fellow of the American Society of Civil Engineers and is the official investigator of the effects of major earthquakes on concrete structures for the American Concrete Institute. . . . I hear that **Gordon Brownell** is at the Physics Research Lab at Tech and that Dr. **Louis Capozzoli, Jr.**, has his own firm, L. J. Capozzoli & Associates, now located at 10601 Airline Highway in Baton Rouge, La. I noticed that **Richard P. Ingalls** recently co-authored an article in *Science* magazine and that he is with the Lincoln Lab in Lexington. . . . **Jack Stewart** is living at 6 Sullivan Way in East Brunswick, N.J. He is with J. C. Penney Company working in the software-buying field. Jack is the father of four children. . . . Dr. **W. H. Culver** is a scientist at IBM Corporation where he recently participated in the development of a new family of lasers that have both the extremely high output power of a giant pulse ruby laser and the very small beam divergence of a gas laser. . . . **Harold Carlson** has been elected as director of the Hedstrom Union Company. Harold is superintendent of the company's Dothan Alabama Plant. . . . The following are address changes that may help you locate long-lost friends. Tell them Gabe sent you when you contact them! Dr. **J. M. Mitchell, Jr.**, 1106 Dogwood Drive, McLean, Va.; **Jim McMartin**, Macsfolly Avenue Farm, Potomac, Md.; Dr. **Thomas Hahn, Jr.**, President's Home, Virginia Polytechnic Institute, Blacksburg, Va.; **Jack Jackson**, 214 Elmwood Avenue, Glen Rock, N.J.; **Carroll Johnson**, Friendly Ice Cream Corporation, 1855 Boston Road, Wilbraham, Mass.; **Peter Harrison**, 1278 Ridgemont Avenue, Ottawa 8, Ontario, Canada; Dr. **Herman Fischer**, Union Carbide, Box 65, Tarrytown, N.Y.; **Gregard Heje**, 19 Søienberg Gate, Oslo 5, Norway; **Bill Hibbs**, Apt. D6 23 East 81st Street, New York, N.Y.; **John Mekota**, Honeywell EDP Department, 200 Smith St., Waltham, Mass.; **Michael J. Demayo**, Demayo-Lonardi S.A. Estomba 250, Buenos Aires, Argentina; **Alex MacMullen**, 7022 Starstone Drive, Palos Verdes Peninsula, Calif.; **Al Franklin**, P.O. Box 352 D.S., Omaha, Neb.; **Ken Garnjost**, 69 Starin Avenue, Buffalo, N.Y.; **Jesus Bondoc**, 3 Twin Hills, Rolling Hills, Quezon City, Philippines; **Charlie Bostick, Jr.**, 1205 Tucker Lane, Ashton, Md.; **Bob Burke**, 19 Probert St., Rochester, N.Y.; **Dick Stephan**, Monasterio 29, San Angel, Mexico; **Barney Byrne**, 2336 S. McKnight Road, Brentwood, Mo. . . . Looking forward to hearing from you in 1967. All the best to you!—**Gabe Stilian**, Secretary, 4 Biscayne Drive, Huntington, N.Y.

'51

Several classmates have recently answered the challenge of new assignments. **Jack Wingard** came from North American Aviation to T. A. Pearson Associates,

Inc., where he is a vice-president and is involved in construction for the Telephone Company, U. S. Rubber, and Westinghouse. . . . **Peter Preston** is now assistant director of research for the American Cyanamid Pigments Division in Piney River, Va., and has started up a new plant in Savannah Ga. . . . **Robert Woolworth** is now with Tippetts Abbott McCarthy Stratton in New York City. . . . And Dr. **John O'Neill, Jr.**, left the film Department of DuPont to become director of engineering at Deering Milliken Research Corporation, Spartanburg, S. C., one of the largest manufacturers of textile mill products. . . . **Harold Glenzel** is bucking for the title of "the class of '51 man on the go," having moved 17 times since graduation; he was last reported as a district engineer for the New England Telephone Company. Can anyone beat 17? . . . **Richard Foster** resigned from Peter Kiewit Sons Company where he was project manager on elevated highway construction and went into his own business. . . . **Ranger Farrell** also started his own firm, Ranger Farrell Associates in Tarrytown, N.Y., after having spent 12 years with Bolt Beranek & Newman Inc., Cambridge, Mass. BB&N is not left without '51 support, however. The class is well represented by **William Cavanaugh**, manager of architectural acoustics, **Parker Hirtle**, senior staff consultant in architectural acoustics, and **Jerome Elkind**, vice-president and division director of man machine information systems. . . . **Henry Marsh** has been promoted by Owens-Corning Fiberglass to supervisor of product development at the Granville Technical Center, Granville, Ohio. He came to Granville from the Newark plant in 1964 and is now in charge of development for the transportation equipment and appliance materials division. . . . **Charles Roddey**, a '51 graduate student, has been appointed vice-president and petroleum-chemical director of the Ralph M. Parsons Company where he is manager of petroleum refinery and chemical plant project development in the Los Angeles headquarters. He is also coordinator of new business in other Parsons offices in New York, Houston, Calgary, Toronto, Paris, London, and Frankfort. . . . Capt. **Austin Hubbard** has recently assumed the position of officer in charge of Coast Guard marine inspection at Port Arthur, Texas. . . . Dr. **Barend deVries**, Deputy Director of the Economic Department, International Bank for Reconstruction and Development, was the speaker at a summer meeting of the Pittsburgh Chapter of the Society for International Development. He has visited and advised countries with the World Bank and International Monetary Fund, and headed IBRD's 1964 mission to Brazil. . . . **Charles Elliott** was a first place winner in the Applied Lighting Competition of the New England Section of the Illuminating Engineering Society. His presentation "Daytime All Night Long" concerned the tower lighting of Abbott Hall in Marblehead, Mass. Charles is a lighting engineer with Sylvania Electric Products, Inc., Danvers, Mass. . . . **William Diffin**, a 15-year man with General Electric, has been the principal engineer in metallurgy

at the Computer Department in Phoenix for two years and reports that the climate suits him fine. . . . We have had a number of requests to elaborate on the class statistics which were culled from our reunion questionnaire. As you may guess, most of the inquiries pertained to the average wage and Figure 23 of the statistics (Average Class Wage vs. Geography). Briefly then: the values reported appeared to be annual income rather than salary, and even at that one might be inclined to feel that some of the reported values were predicated on the stock market not falling too drastically. The mean salary (or income), was not determined, but it was noted that the values bunched in two areas: around \$15 to \$20 thousand, and around \$30,000, and the spread was from \$6000 (a high school teacher) to several over \$100,000, with a few in the \$50 to \$60 thousand range. All of the people reporting received their Baccalaureate degree in '51. We would be happy to receive suggestions as to how to improve the questionnaire without destroying the reunion-by-reunion continuity of it. One interesting aspect is that the class of '56 used a similar study, and their results last year (their 10th reunion), were very similar to those of our 10th. Any further questions will be answered provided they are accompanied by some class news.

This year's classmates who are active in the Alumni Fund as area Chairmen are: **Elliott Cutting**, Pasadena; **Harry J. Zimmer**, Rockville, Md.; **Adolph C. Hendrickson**, Silver Spring, Md.; **Thomas P. E. Kelly, Jr.**, Fitchburg, Mass.; **Paul G. Smith**, Caldwell, N.J.; **John D. O'Brien**, Rochester, N.Y.; and **Donald Lee Brown**, Richmond, Va. . . . **Ken Kruger** has opened up a new office on Long Wharf in Boston, Mass. Ken practices architecture, engineering and planning. This office is in addition to his Newark, N.J. location. . . . **Fiore DiGiovine** is now the production superintendent at the Cambridge, Mass., facilities of the Boston Woven Hose & rubber Division of American Biltrite Rubber Company, Inc. . . . **Douglas Kaufman** has been purifying beryllium by zone refining as staff metallurgist for the Nuclear Metals Division of Textron Inc., Concord, Mass., which was recently acquired by the Whitaker Corporation. . . . Your Assistant Secretary had the opportunity to visit with **Forest Monkman** in his new home in Kansas City, Kan., in the fall. Monk reported that he and **Breene Kerr** represented the crew members of the class at the dedication of the new boat house in September. At the instigation of Bob Uhl, '50, eight oarsmen were found, and they took the first shell out from the new dock. The old boys had lost none of their fine technique. Breene demonstrated his proficiency in the famous Kerr crab-recovery stroke, and then went back to Washington where NASA has him assigned to seeing that the new technology coming out of the space program research is made available not only to the companies working in the space program, but also to the non-aerospace industries. For this month—**Paul Smith**, Assistant Secretary, 11 Old Farm Rd., N. Caldwell, N.J. 07007; **How-**

ard L. Levingston, Secretary, 358 Emerson Rd., Lexington, Mass. 02173; Assistant Secretaries: **Marshal Alper**, 1130 Coronet Ave., Pasadena, Calif. 91107; **Walter Davis**, 346 Forest Ave., Brockton, Mass.

'54

Dr. Roy Kaplow, VIII, co-authored an article in September's *Journal of Chemical Physics* entitled "Relationship Between Pair Potentials and Distribution Functions." . . . **Dr. Anthony Turano**, X, writes from London, England, that he was transferred there by the Standard Oil Company (N.J.) as part of a group of about 500 Americans and Europeans to form a new company, Esso Europe, Inc. Their job will be to "manage" the parent company's interests in Europe, and it is hoped that "inter-country planning can be done better from this vantage point—by people whose only concern is Europe." . . .

Dr. Ed Eigel, XVIII, writes that he and Marcia are "finally in a house of our own (since August 1965) with Eddie age 6 and Mary age 5." Ed is an associate professor of mathematics and assistant to the Dean of the Graduate School at St. Louis University where he was recently honored with the 1966 Nancy McNair Ring Award. This award is given annually by the Women's Jesuit Honor Society, Gamma Pi Epsilon, to the outstanding faculty member on campus. . . . With regret I must report the death in November of **Dr. Paul H. Goodman** who was associate professor of electrical engineering at Newark College of Engineering. . . . **Dr. Arnold Berger** is a member of a commission which studied areas of cooperation between Case Institute of Technology and Western Reserve University. Upon recommendation of the Commission four joint departments, physics, chemistry, mathematics and biology, will be established to serve both academic communities in a quest for the highest levels of academic excellence. . . . **Edward P. Warekois** of the Solid State Division of M.I.T. Lincoln Laboratories is vice-chairman of the TMS Electronic Materials Committee and served as program chairman for an IMD Electronic Materials Conference held in August in Boston. He reported on this conference in October's *Journal of Metals* in an article entitled "Material Research Helps Transpose Science Fiction into Fact."—**E. David Howes, Jr.**, Acting Secretary, Box 66, Carlisle, Mass. 01741

'56

Fred Cartwood (Fahrenholz) is working on gyro test and evaluation at the Tech Instrumentation Lab. The Cartwoods have two daughters, Kristine and Kathrin, and at last report were expecting to have a third child in December. **JoEd Davis** is doing market research for the Solar Division of International Harvester in San Diego but finds time to race Catamarans in the Pacific and ski at Sun

Valley. . . . **George Garfinkle** has formed his own architectural firm in Boston and is designing numerous residential, commercial, and institutional buildings in New England and Puerto Rico. George and Shirley have three daughters. . . . **Bob MacDonald** is doing research on VTOL stabilization and guidance systems at Tech's Instrumentation Lab. Bob and Mary were wed in 1963. . . . **Pete Parsonson** is an assistant professor of civil engineering at the University of South Carolina and specializes in traffic and transportation. Pete received his Ph.D. from North Carolina State last July where he had studied on a Ford Foundation Fellowship. He is also a professional engineer in North Carolina. Pete wed Marilyn Shepherd of Concord, N.C., in 1961 and they have a daughter. Between getting his masters from Tech and returning to school in 1964, he worked in Alaska, Argentina, and Venezuela. . . .

Houston Payne writes that he is in nylon fiber process and product development at duPont's Chattanooga, Tenn., plant. Houston received his Ph.D. in chemical engineering from Rice in June 1964. He wed Evelyn Powell in Houston in 1963 and they have a son David. . . . **Ray Peck** is a systems engineer for IBM in Sacramento and is involved in selling, installing and servicing computers. He also manages a few business trips to Europe. Ray was married in 1962 and the Peck's have two sons. He is also active in Tech's Educational Council. **Bill Peter** is now engaged in fiber market planning in the carpet industry for the duPont Company in Wilmington, Del. after working in research for several years. In 1965 he presented a paper on research planning at an AICHE meeting. The Peters have four children. **John Sirmalis** is head of the torpedo system analysis at the Naval Underwater Weapons Research and Engineering Station in Rhode Island. The Sirmalis's have four children, but John still manages to take a few courses at the University of Rhode Island. . . .

Ernest Wolff was promoted to assistant section chief of the Metals and Ceramics Research Section at AVCO's Wilmington, Mass., plant. He was married in 1961 and the Wolff's have four children. Ernest also informs us that **Tom Comparato** works in the same plant. . . . The questionnaires and the reunion have provided a fund of information for the notes this past year and now that you have learned how—keep on writing!—Co-Secretaries: **Bruce B. Bredehoft**, 16 Millbrook Road, Westwood, Mass. 02090; **T. Guy Spencer, Jr.**, M.I.T., Room E19-439, Cambridge, Mass. 02139

'57 CLASS REUNION

June 9, 10, and 11

As promised last month, here is a brief rundown on the activities of **Paul Nicholson**. Paul is now working for his Ph.D. in Physics at the Imperial College of the University of London. He has finished his course work and is now progressing his thesis which will be on an aspect of high energy physics. Paul is on leave from Raytheon where he has been em-

ployed since 1958. His latest assignment with Raytheon was with the Space Division in Sudbury, Mass. Paul insists that his wife, Ginny, is only a housewife, but I got the impression from her that tending three children, studying French, playing the piano and keeping warm in a house without central heating is more than a full-time job. Paul recently heard from **Lee Niemela**. Lee is now living in Washington D.C. and working with the Department of Defense in systems analysis. He received his Ph.D. from Tech in 1961. Before going to Washington Lee did research work for CERN in Geneva, Switzerland. Lee and his wife recently received the blessings of twins. . . . **Dr. Charles L. Felman** has been appointed by the Harvard Medical School as a research associate in biomathematics in the Department of Psychiatry. He received his Sc.D. from M.I.T. in 1962 and has been associated with the Massachusetts General Hospital. . . . **Guy Carbone**, who is a member of the Watertown School Committee, has been named project engineer for the 43.5 million dollar Health, Welfare and Education Center scheduled for construction soon in Boston. Guy is President of A. Carbone Construction Company of Watertown. He will serve as an advisor to the Government Center Commission and supervise construction. . . . **Capt. Darrell Fowler** recently wrote, "I've been here in Ann Arbor since last August—am still in the army. They've sent me here to U. of M. graduate school. I'll probably be here until next spring when I expect to get my M.S. in physics."

. . . **Dick Mortensen** has been appointed visiting assistant professor of aerospace engineering sciences at the University of Colorado. Dick received a doctorate from the University of California at Berkeley. He was an assistant professor at the University of California at Los Angeles specializing in communications, control and systems theory and electromagnetic theory. He has also taught on the Berkeley Campus. . . . The wife of Dr. **Richard E. Smith** recently dropped me the following note. "My husband graduated from Johns Hopkins Medical School in 1961, took on internship and residency in Internal Medicine there, 1961-1964, post-residency fellowship work in cancer (1964-February 1966) and was drafted by the Army in March 1966." That's all for now. More tidbits in 30 days—**Frederick L. Morefield**, Secretary, 18 Whaddon House, William Mews, London, S.W.1 England

'58

Several notes and letters have come in this new year—which looks like a trend. I don't know if it is because we are more communicative or that now we can finally become Review subscribers. As you have all noticed, I'm sure, the Review has a new look which really reflects M.I.T. excellence and vitality. Hope you will encourage any classmate not now receiving the Review to do so. Our first letter is from **Kenneth Langley**: "After finishing my P.H.D. in Physics at the University

of California at Berkeley, I spent until September 1966 on a post-doctoral appointment there. Did some research and taught during the spring semester. This fall I joined the fast-growing physics department faculty at the University of Massachusetts in Amherst. The department is adding about five faculty members per year and is increasing the number of graduate students as part of a large expansion program. We're happy to announce the arrival of Mark Douglass in October, bringing the balance up nicely to one girl and one boy." . . . **David Bentley** writes that he is "presently employed as a development chemist at National Starch and Chemical Corporation, in Plainfield, N.J. Our first son, Stephen Joseph, was born in October 1966, and he joins three sisters—Karen 5, Anne 3, and Joan 1. In addition to the business and family activities, I am also a member of the Westfield, N.J., Volunteer Rescue Squad." . . . **Jesse Wallace** is now employed by Federal Cartridge Corporation as a Department Head. The firm is engaged in re-activating a small arms ammunition plant for the Federal government which had been closed for about seven years. A year ago last May Jesse, wife Mary and two children survived a tornado that demolished their home in Fridley, Minn. Fortunately everyone in the family was safe and unharmed and they were able to collect the limit on their insurance. . . . **Daniel Brand** is the head of the Boston office of the Traffic Research Corporation and is a Group director of the firm. He writes: "All systems analyst types desiring (peaceful) applications work on transportation and urban problems are much in demand. My wife Erika and two little girls Anika, 20 months, and Taika, 8 months, and I are comfortably ensconced in Marblehead, Mass., a great town to live in!" . . . In the December issue you may have noticed the article on the IFC Purchasing Council which has finally emerged as an integral part of IFC's work. This proposal, of course, started with **Bob Jordan** during our days at Tech, as acknowledged in the article. Some of 58's great ideas just take a little while. Bob received a Christmas card from all the Jordans who are still living in Virginia.—**Michael E. Brose**, Secretary, 1171 North Street, Walpole, Mass.; **Antonia D. Schuman**, Western Associate, 22400 Napa Street, Canoga Park, Calif.

'60

First things first: Rudy and Marloth's child name is Gillian. And now on to other news. From George Harrison, '61, we hear that **Bob Moorhouse** is working for Boeing at Kent Space Center and that **Tony Johnson** is at the Yale School of Drama. . . . **Sidney Ossakow** recently received his Ph.D. in theoretical plasma physics from U.C.L.A.; he is now a research associate at the Plasma Physics Laboratory at Princeton. He says that, "After spending six years in Southern California, it's quite an effort to get accustomed to the cold weather in the

East." . . . **Addison Ball**'s picture showed up in the *Transactions of the IEEE*; with the picture was this information: in 1960 and 1961 he was a design engineer with the Chesapeake Instrument Corporation, Shadyside, Md. Since 1961 he has been associated with the Department of Defense, Washington, D.C., where he has been concerned with the specification, evaluation, and programming of general purpose computer systems. . . . **Herb Fox** has an article (co-authored with Ivan Fox) in the fall issue of the *American Business Law Journal*: "An Introduction to Space Law for the Business Community." Herb is assistant professor of aeronautics and astronautics at N.Y.U.; he got an M.S. in 1962 from the Polytechnic Institute of Brooklyn, and a Ph.D. there in 1964. . . . **Tony Aldrich**, who is in his last year at the Harvard Business School, has been named one of 15 Baker Scholars there this year. . . . **James Kwok Suen Lee** received an M.S. in Electrical Engineering from the University of Santa Clara, Calif., in June 1966.

Malcolm R. Blotner, '56, manager of operations analysis for Lever Brothers Company. (See *An Institute Gazette*, February.)



. . . **Edward McCartney** has been promoted to a design engineer senior at the Maytag Company in Newton, Iowa; he joined the firm in 1960 as a design engineer junior, was named a design engineer in 1962. He is married and has two daughters. . . . **Colonel Charles Scolatti** has assumed the position of vice-commander of the Aerospace Research Laboratories, Office of Aerospace Research, Wright-Patterson AFB, Ohio. He served with OAR in Washington, D.C., prior to his appointment at Wright-Patterson. He is married to the former Mary Schillinger from Tipp City, Ohio. . . . **Irving Levinson**, who was chief of the Operations Research Office, Systems Division, Defense Supply Agency, has accepted a position as executive assistant to the commanding general of the Supply and Maintenance Agency, U.S. Army, Europe. He is stationed in Orleans, France. . . . **Gerald Brown** received his Ph.D. in mathematics from the University of Wisconsin in August 1965. . . . **Ron Agronin** was appointed senior process engineer, paper machines, of the Texas Division of Champion Paper in December 1966. . . . **Howard Hornfeld** has accepted a post as research chemist with the Dupont Jackson Laboratory; he has completed the requirements for his doctor's degree in organic chemistry from the University of Sussex, England. . . . **Dennis Staton** has been appointed Research Fellow in Anatomy with the Harvard Medical School; he is associated with the New England Primate Research Center in Southboro, Mass. . . . And, I

have a new job: I am now editor of the Management Resource Project being carried on at B.U. under a NASA grant. Write soon, everyone else does, to—**Linda G. Sprague**, 345 Brookline Street, Cambridge, Mass. 02139

'61

Only a short column this time. We are moving this week and with the resultant confusion I can't seem to find all of my notes. When I do find them rest assured that they will appear in the column. Please note my new address below. Everyone says that "Tech is Hell" but no one does anything about it. Now the Encyclopaedia Britannica has. It enlisted the aid of **Charlie Sprich** to write the article "Hell" in recent volumes. Upon leaving our brand of Hell he went to Brandeis for an M.A. and then chugged north to Tufts, where he is still a student toiling toward a Ph.D. Along the way he has taught at Northeastern, Tufts, M.I.T., and the Boston Center. Now he is an assistant professor of English at Bentley College in Boston. . . . **Charles Phillips** is in Washington, D.C., as a Federal Intern in the Department of Commerce. . . . **Fred Hanser** taught at the Southeastern Mass. Technological Institute last term while going for a Ph.D. at M.I.T. Fred taught physics at SMTI. . . . **Garnet Nelson** got a Masters from the University of Virginia graduate School of Business Administration a few years back and then in 1964 joined the Life Insurance Company of Virginia. Moving up the executive ladder fast he was promoted to the position of investment officer last December.



John H.
Sununu, '61

. . . Moving up the academic ladder is **John Sununu**. A couple of months ago he became assistant professor of mechanical engineering at Tufts. John's fields of work are: flows of variable viscosity fluids, and the flow of two phase mixtures. . . . **Jon Wolfe** got his Ph.D. from the University of Massachusetts in organic chemistry last year. Diploma in hand he started working at DuPont's Plastics Department in Wilmington soon after. . . . The Christmas mail brought a couple of pleasant cards and letters. There is only time for selected excerpts: **Tom Ising** is "teaching at Loyola U. in Chicago this year. I am still finishing my Ph.D. in Economics at Illinois. Just a dissertation to go! Chuckie, our son, is in kindergarten and is doing O.K. Carol is taking off a year to play housewife. She enjoys it." . . . **Ron Uhl**: "I received my Ph.D. in Physics (high energy) from the University

of Maryland early in this year (1966). I then received a faculty appointment at the same institution, but I was not able to stay very long. I was called to active duty in March and spent a short time training at Aberdeen Proving Ground, Md. While there I met **Frank Bachner** who was called to active duty one month after I was. After completing the training I was assigned to the Pentagon where I am now serving as chief of the Operations Research Branch, Headquarters Information Systems Development Division, U.S. Army Information and Data Systems Command. At the end of my tour of duty I intend to return to doing research and teaching at some university." . . . **Dave Williams** says he "finally got my Ph.D. at the University of Florida in Physical Inorganic Chemistry. I am now working for General Precision in Little Falls, N.J., and live in Lyndhurst. Anyone in the area is welcome to stop by." Anyone? . . . Finally I got a monster letter from the **Robert Creasy** family. The gist of it was that due to the effects of the Boston climate on Bobs ear, they decided a move to moderate climes would be worthwhile. IBM obliged by transferring him to the Scientific Center near Stanford U. in Palo Alto. They live in a duplex in Sunnyvale, 9 miles from IBM and 35 from The City. The trip West is described in vivid detail, but what interested me most was their lesson in parenthood. Towit: "Monday and Tuesday we had planned to spend in Disneyland. As we drove into Anaheim we spotted a billboard proclaiming the virtues of the land of Disney and noting (in small letters) 'Closed Mondays and Tuesdays'. Being old hands at the parent game, we had not informed the children (ages 3 and 5) of our destination, so we were spared a scene." I'll have to remember that one.

Pete Bankson is in Vietnam. He wrote an interesting letter to **Pete Buttner** who passed it on to me. Here are some quotes: "I am assigned as the senior advisor to Duc Pho subsector. Duc Pho is located on the coast, at the southern limit of Quang Ngai Province. On military maps, Duc Pho is the tiny southern bump next to the boundary between I Corps and II Corps. I have three other Americans, a 1st Lt. (artillery), a SFC (medical specialist) and a PSG (light weapons infantryman). Our mission is to assist a district chief in all aspects of his work, civil and military. In addition to all types of advice ('Let's have an alert sometime to see if the guards know which bunker to use!') we deal in services by coordinating all U.S. combat support and combat service support for the district. This includes USAF medical evacuation, Army helicopter supply and transportation in and out of the district HQ for all government employees. We are the only Americans for about 20 miles around and function on our own initiative most of the time. In the southern part of the district the mountains come down to the sea (on the border between Quang Ngai and Binh Diah Provinces). This has been an area of guerilla strength since the late '50s. Tonight my enemy situation map shows four battalions, three separate companies and eight platoons of V.C., about 2500

V.C. in all, within 10 km. of the house. Protecting the secure area we have about 450 popular forces, armed with M-1 carbines and a few BAR's. The V.C. control about 90% of the district, which is why we have to come and go by helicopter. For all the strength the V.C. cause little trouble. Most of them are here to rest from battles in the central highlands and want to be left alone. Also this area is rich in rice and has one of five major salt-producing operations in Vietnam, and the V.C. need rice and salt. Since we lack the strength to interfere with them, they don't bother us very much. It does get on your nerves every once in a while, though, to realize that there aren't any regular troops for miles around and all those V.C. are out there. In the face of all this enemy threat, we teach English (My exec. teaches at a nearby Catholic orphanage every morning, and I'm about to start evening classes for several of the village merchants), assist in refugee welfare, make inspection visits to outposts in the few hamlets that are under government controls, and on occasion we round up enough troops to go on a small search and destroy operation. I feel that my role here is to know as much as I can about the area and its people in case military operations are planned here, and to do as much as I can to build the image that the Americans are here to help the Vietnamese Government help the people. It's a big order and I'll have a busy year." Pete's address is: Capt. Peter R. Bankson 092308, ADV TM 2, APO San Francisco, Calif. 96260. Mail takes about a week. . . . Get set fans, here it is, my new address (the phone number stays the same, mail takes about a week)—**Andrew Braun**, 131 Freeman Street, Brookline Mass. 02146

'62 CLASS REUNION

June 9, 10, and 11

I received a newsy letter from **Jim Ross**. He received his Ph.D. from M.I.T. last September and is currently an instructor working with Professor Anthony French in the Science Teaching Teacher. . . .

Elwyn Berlekamp received his Ph.D. from M.I.T. in September 1964 and immediately joined the faculty of the University of California at Berkeley as an assistant professor. He has published a number of papers in his field (information theory) and has decided to join the staff of Bell Telephone Laboratories, Murray Hill, N.J., in the spring. Elwyn married the former Jennifer Wilson (a girl he met in California) last August. . . . **Mike Lieberman** received his Ph.D. in electrical engineering from M.I.T. in September 1966, and like Elwyn has joined the staff at Cal of Berkeley as an assistant professor. Mike's field is beam-plasma interactions. He married the former Marlene Kay, a Smith graduate from Findlay, Ohio, in June 1965. They have taken the apartment recently vacated by Elwyn. Marlene should have given birth to their first child by now, since it was due in February. . . . **Ken Gentle**, who was "straight A" as an undergraduate, kept his record unblemished and received his Ph.D. in

(plasma) physics from M.I.T. in September 1965. Ken was an instructor at M.I.T. until last June when he went to Europe (Trieste) for an international plasma conference. He is currently an assistant professor at the University of Texas and is still a bachelor. . . . **Bob Gilmore** has almost completed work on his Ph.D. thesis at M.I.T. and may have received his degree by now. He is now a judo "black-belt" and will probably become engaged very shortly (Sec. note—no relation between those facts implied). Bob's field of endeavor is theoretical physics (specifically group theory). . . . **Tom Greytak** expects to receive his Ph.D. from M.I.T. shortly and will then become an instructor. His field is solid state physics. Last June he married the former Betsy Bardeen, a Wellesley graduate whose father John is a Nobel Laureate. . . . **Paul Schroeder**, another physicist, is working with lasers and expects to receive his Ph.D. from M.I.T. in February or March. He married the former Mary Jo Cahill, a Colby graduate, from Stoneham, Mass., last February. Mary Jo should have had their first child by now, since she, as Mrs. Lieberman, was expecting in February. . . . **Roger Sullivan** is another physicist who, after enjoying a year in Europe on a Fulbright scholarship, is back here working for his Ph.D. in cosmic ray physics. Roger hopes to finish by this coming June. Last August he married the former Sue Goodpaster, a Wellesley graduate who is the daughter of Lt. General Andrew J. Goodpaster. **Jim Ross** was an usher at their wedding, as well as **Ed Feustel** and **Irv Thomae**. Ed obtained his M.S. at M.I.T. in E.E. (information theory) in 1964 and has just about completed the requirements for his Ph.D. at Princeton. Ed is still a bachelor. Irv Thomae married the former Sally Campbell, a Wichita girl who graduated from Wellesley and is now at Harvard, a few days after our commencement. Irv got his S.B. in physics, but has since switched over into the Electrical Engineering Department (in neural biophysics). Irv hopes to receive his degree in June. Irv and Sally have no children yet. Jim's letter also bore some unhappy tidings. **Jim Ellis** completed the requirements for his M.S. in Electrical Engineering and received that degree from M.I.T. in June 1964. One week later he was hit by a car while crossing Massachusetts Avenue, and his left leg was severely crushed. Jim was in Peter Bent Brigham Hospital for many months, and his leg was partially healed, although a future operation may still be necessary. He dropped out of school (having been a Ph.D. candidate until then) and went home to Tulsa where he got a job with North American Aviation Company. Last May his mother died of cancer. Jim, who ushered at Elwyn's wedding, says he is not coming back to M.I.T. but may get his Ph.D. somewhere else eventually. I am certain that I speak for the entire class in wishing Jim a complete and total recovery and a happy future. . . . Thanks to Jim Ross who wins the Snoopy award for newshound of the month.—**Jerry Katell**, Oceanic Properties, Inc., One Bush Street, San Francisco, Calif. 94104

4 '63

It's getting to the point where even newspaper clippings about classmates are becoming rare. Somebody had better send some news soon. Otherwise this is what you should expect in the future: "**Frank Levy** is writing his doctoral dissertation on the financial costs of integrating Boston's elementary schools." Or how about: "**Dr. Saul Cherkofsky** has joined the staff of the DuPont Company's Central Research Department at the Experimental Center near Wilmington." Or: "A research paper by **Daniel Wilkins** has won for him the annual Mark Mills Award of the American Nuclear Society." And; "**Ben Saievetz** spent a year with McDonnel after getting his M.B.A. from Harvard. Now he is with TWA as an operations analyst." Also: "First Lt. **Ken Wyler** is now with the A.F. Military Airlift Command and is stationed at McChord A.F.B., Washington." Somebody please send some news to—**Bob Johnson**, 245 E. 19 St., N.Y., N.Y. 10003

M.S. in Chemical Engineering at M.I.T. in 1965. . . . **Tom Herbert** and his wife Kathy have a very cute little girl named Janet. . . . **Ray Leanza** is a second lieutenant in the Air Force, is a bona fide jet pilot, and is stationed in Arizona as a pilot instructor. He is reported to be enjoying flying more than E.E.! **Dick McEntire** is well along in his Ph.D. program in space physics at the University of Minnesota. . . . **Mike Murray** is in E.E. at Berkeley and recently passed his qualifying exams. He was married to the former Amy Cohen of Radcliffe last year. . . . **Ken Schatten** is working on a Ph.D. in physics at Berkeley. He is doing research in plasma physics. . . . **Bob Scott** was married to the former Miss Sherry Fink in Detroit late in '66. **Bob Kimmel** was a member of the wedding party. . . . **Sam Taub** has passed his Ph.D. qualifying exams in physics at Brooklyn Polytech. I spotted Sam in downtown Boston in the fall, and he is looking well. . . . **Al Weinstein** is working on his Ph.D. at Berkeley. That's it for this month.—**Ron Gilman**, 202A Holden Green, Cambridge, Mass. 02138

'64

This issue has yielded three class heros, Doug McCallum, John Freeman, and Mel Oliven, all of whom wrote letters and contributed news of others. Similar action from members of '64 we haven't heard from in several years would be of great interest to the class and much appreciated. **Doug McCallum** received his M.S. in Regional Planning at the University of North Carolina in June and is now working on his Ph.D. Last summer he was in Bogota, Columbia, on an OAS Fellowship. His wife, the former Jan Kozyna of Simmons '64, is working as an economist for the North Carolina Fund, a poverty and economic development body. Doug reports he loves living on a rural route a few miles from the university—and only 10 minutes away. . . . **John Freeman** and his wife Margaret both received their masters from the University of New Mexico in June. Margaret is now a counselor at a high school, and John is finishing up his doctorate in E.E. He says he has one more year to go. . . . **Mel Oliven** is working on his Ph.D. in Space Physics at the University of Iowa. His wife Carol is working toward her Ph.D. there in Economics. They both have received their masters degrees. Mel has been working with "Radiation Belt" Van Allen himself, and has been coast to coast presenting scientific papers on some satellite experiments and balloon research he conducted in the summer of 1965 in the Arctic. Carol and Mel are houseparents to a large co-ed dorm with all the modern conveniences 1000 students require—indoor swimming pool, sauna baths, etc! . . . And now the news of others: **Richard Boyd** is an assistant professor of mathematics at the University of Michigan. . . . **Danny Chow** has been working for Pratt-Whitney in Hartford, Conn., since he got his

'65

Many thanks to those of you who sent in news items this past month; keep them coming. **Bary Pollack** received his Masters in Computer Science at Stanford University in June and is now working towards his Ph.D. . . . **Bill Podolsky** is working towards his Ph.D. in Physics at the University of California at Berkeley. . . . **Jim Larsen** and Miss Dee Dresser are engaged to be married in June. . . . **Edwin Kampmann** is currently in the Ph.D. program in City and Regional Planning at the University of Calif. at Berkeley, and in his spare time has taken up playing the oboe. . . . **Marshall Fisher** is back at the Sloan School. . . . **Steve Lipner** has passed his qualifying exams in civil engineering at M.I.T. . . . **Jim Taylor** finished his masters work at the Sloan School and is now in Baton Rouge working for Humble Oil. . . . **John Larkin** was married last Easter Sunday to the former Miss Lucille Anne Walbridge. John is currently working towards his B.D. degree at Gordon Divinity School in Beverly, Mass. . . . **Richard Schwarz** is doing graduate study at Duke University. . . . **Willard Welch** married the former Miss Winona Hart in June and is now working towards his Ph.D. at Rice University in Houston, Texas. . . . **Gene Chase** is in the Ph.D. program at Cornell while also teaching mathematics at Houghton College in New York. . . . **Lowell Anderson** is working at Honeywell in Wellesley, Mass., as an instructor on computer trouble-shooting and repair. . . . **Dennis Bekeny** is engaged to Martha Wilson with the wedding planned for June 3, 1967. Dennis is currently at M.I.T. doing graduate study in the Department of Food Science and Nutrition. . . . **Steve Ivester** entered the Coast Guard in February. . . . **Don Shulman** married the former Miss Jill Colby of

Pittsfield, Mass., on December 26, 1966.
—**Jim Wolf**, Secretary, McCulloch C-41,
Harvard Business School, Soldiers Field
Road, Boston, Mass. 02163

Graduate Students

V

Interviewers visiting the Department of Chemistry during the first term of this academic year who had previously been awarded advanced degrees in chemistry from M.I.T. were as follows: (Perhaps I should add that many industries have adopted the policy of assigning alumni who are engaged in research to interview candidates for the doctorate on an immediate or long-range basis.) Dr. Barry Bloom, Ph.D., 1951, Chas. Pfizer and Company; Dr. Jay H. Vreeland, Ph.D., 1958, S. D. Warren Company; Dr. Edward Atkinson, Ph.D., 1936, Arthur D. Little Company; Dr. Robert W. Walker, Ph.D., 1952, Rohm and Haas Company; Dr. Dale W. Rice, Ph.D., 1961, Corning



James E. Cantrill,
V, Ph.D. '59

Glass Company; Dr. Paul H. L. Walters, S.B., M.I.T. Ph.D., University of Kansas, 1960 E. I. du Pont de Nemours and Company, Inc.; Dr. E. P. Przybylowicz, Ph.D., 1956, Eastman Kodak Company; Dr. William A. Bolhofer, Ph.D., 1950, Merck and Company; Dr. John Wollensak, Ph.D., 1958, The Ethyl Corporation; Dr. W. F. Erman, Ph.D., 1957, The Procter and Gamble Company; Dr. Charles M. Starks, Ph.D., 1955, Continental Oil Company; Dr. Robert S. MacDonald, Ph.D., 1952, The General Electric Company; Dr. W. F. Gorham, Ph.D., 1951, The Union Carbide Company; Dr. C. N. Winnick, S.B., M.I.T., 1948; Ph.D., University of Illinois, 1951 Halcon International; Dr. Richard F. Merritt, Ph.D., 1962, Rohm and Haas, Huntsville, Alabama; Dr. Herbert C. Wohlers, Ph.D., 1944, Allied Chemical Company; Dr. Leonard Leum, Ph.D., 1936, Arco Chemical Company—a division of Atlantic Refining; Dr. R. A. Laudise, Ph.D., 1956 and Dr. A. D. Pearson, Ph.D., 1957, both representing The Bell Telephone Laboratories. The interview schedules were also open to our 56 research associates and 9 postdoctoral fellows. About one-half are foreign nationals who received their doctorates in colleges and universities outside the United States—in England, Switzerland, Yugoslavia, Australia, Austria, Finland, Sweden, France,

Japan, Israel, Italy, Argentina, Germany, Holland and India. A year or two of postdoctoral study seems to be in vogue in this day of specialization, though some of those who visited the department, who did not have the opportunity to specialize, question the procedure, except for those who are interested in a teaching career. Time will tell, but the trend toward further education is evident.

The content of a letter from **A. Truman Schwartz**, Ph.D., June 1963, (dated January 10, 1967) will be of interest to many of the alumni who were in residence at that time. From M.I.T. he went to the Miami Valley Laboratories of the Procter and Gamble Company, devoted primarily to basic investigations in all branches of chemistry. A long paragraph on his research on substances and equipment is omitted, but related to the biophysical chemistry of proteins in which he made some notable contributions. In March of 1965 he returned to his alma mater, the University of South Dakota, where as the Arthur Lee Haines Lecturer and Visiting Scientist in Chemistry, he lectured and renewed his acquaintances with his former professors. In August 1966 he resigned his position at Procter and Gamble to accept an assistant professorship at Macalester College, St. Paul, Minn., a "vigorous liberal arts college of about 1,800 students," where he teaches general chemistry and advanced physical chemistry. The Chairman of the Department of Chemistry is Dr. **Emil J. Slowinski**, Ph.D. Chemistry, M.I.T., 1949. He is continuing his research in protein chemistry, collaborating with a number of faculty members of the University of Minnesota. He ends his letter, "Beverly and I have one son, Ronald Eric, born September 5, 1964, in Cincinnati. We live at 1876 Wellesley Avenue, St. Paul, Minn., 55105." . . . **James T. Corless** has been on the faculty of the Graduate School of Oceanography in the University of Rhode Island since the award of his doctorate in September 1963. His research has been concerned with stable isotope geochemistry in sea water. He and his wife, Inge, would welcome seeing any former M.I.T. friends at their home at 38 Helme Road, Kingston, R.I. They have two children, ages five and one. "Jims" studied in the inorganic nuclear field under Professor Glenn Gordon (Chemistry) and **John Winchester**, Ph.D., Chemistry, 1955, and until recently a professor in the Department of Geology, M.I.T. . . . A letter from **Richard A. Durst**, dated November 18, 1966, was welcome and will be of interest to those who knew him. After receiving his degree of Doctor of Philosophy in September 1963, he joined the Bureau of Standards as a resident research associate (postdoctoral). For the academic year 1964-65 he was a visiting assistant professor of chemistry at Pomona College in Claremont, Calif., which he describes as one of the best-equipped and academically distinguished undergraduate colleges in the country. The following year he returned to Boston College, his alma mater, as an assistant professor. However, a strong desire to concentrate on fundamental research led him back to the Bureau of

Standards where he is a research chemist in analytical chemistry. He is situated in their new laboratory in suburban Maryland. "Bob" was married in August 1964. He and his wife Susan have a daughter Kierstin (15 months) and hopes for a son—on the way as of November 1966. If in Washington, call him at Chemistry B-326, Department of Commerce, National Bureau of Standards, Washington, D.C.

Dr. **James E. Cantrill**, Ph.D. '59, has been named manager, advanced development, for the General Electric Polycarbonate Research and Development Section in Pittsfield, Mass. He will be responsible for the operation of advanced development, which includes the development of new technology associated with polycarbonates and the raw materials from which they are made. Since joining General Electric Dr. Cantrill has filed three patent applications relating to polycarbonate resins, for which he has received monetary awards and a patent medallion. Prior to this he worked as a research chemist for the Eastman Kodak Company in Rochester, N.Y., and served as chairman of the Department of Chemistry at Villa Madonna College in Covington, Ky., for three years. He and Mrs. Cantrill, with their five small daughters and one son, live on Strong Avenue, Pittsfield.—
Professor Leicester F. Hamilton, Room 4-258, M.I.T., Cambridge, Mass. 02139

VI

Thomas J. Lynch, S.M. '59, has responded to our graduate students column saying that he considers it a welcome addition to the magazine. While studying at M.I.T. he was a research assistant in the Servomechanisms Laboratory where he worked on the design, construction and test of a Doppler-radio receiver. The two years following his M.I.T. study were spent with Westinghouse in Baltimore in advanced radar systems. In 1961 he joined the NASA Goddard Space Flight Center at Greenbelt, Md., where he is now engaged in data-compression research. An important milestone was the award of the Ph.D. degree in Electrical Engineering in June, 1966, from the University of Maryland. Dr. Lynch became a licensed professional engineer in the state of New York in 1960 and expressed a strong feeling about the lack of professionalism among engineers and the apathy of engineers toward professional registration, remarking that only about ten per cent of all engineers are registered. His military service as First Lieutenant in the U.S. Army followed his graduation from the City College of New York in 1955. . . . **Dennis E. Speliotis**, S.M. '57, E.E. '58, is manager of advanced recording technology with the IBM Systems Development Division at Boulder, Colo. One of our Course VI-A students, Nathan Curland, was on assignment with Dr. Speliotis last summer and gained valuable experience in the field of magnetic recording and the application of computer programming to magnetic research. A native

of Greece, Dr. Speliotis did his undergraduate work in electrical engineering at the University of Rhode Island and entered M.I.T. in 1955 as a teaching assistant. His Master's thesis was on magnetic frequency multipliers under the supervision of Dr. Alexander Kusko, S.M. '44, Sc.D. '51. Dennis did further graduate work in solid-state physics at the University of Minnesota and was awarded the Ph.D. degree there in 1961, after which he joined IBM at Poughkeepsie.

Anthony P. DiVincenzo, S.M. '47, has been appointed assistant division manager at the Control Division of Reliance Electric and Engineering Company of Cleveland, Ohio. He also retains his former position of division engineering manager. He joined Reliance in 1947 as supervisor of control development engineering following his graduate work at M.I.T. His undergraduate work was done at Case Institute of Technology, and after two years of industrial experience in the design of hydro and steam power plants, he joined the U.S. Navy in 1942 and completed a course at the M.I.T. Radar School. He then went to sea as lieutenant with the Pacific Fleet, returning to the M.I.T. Radar School as a laboratory instructor in 1945. Active in professional engineering associations, he is a member of the National Electrical Manufacturers Association and the Institute of Electrical and Electronics Engineers. He has served as an officer and executive committee man for the Cleveland Section, I.E.E.E. and as a director of the Northeastern Ohio Science Fair. . . . **Russell R. Pfeiffer**, S.M. '60, Ph.D. '63, joined the Faculty of Washington University in St. Louis last fall as associate professor of electrical engineering. His particular interest is in engineering biophysics, specifically in sensory communication in animals. He is seeking to determine how the information and signals are assembled and transmitted through the auditory system as a whole. In his doctoral thesis under the supervision of Professor **William M. Siebert**, he made an experimental and theoretical study of transducer units in the ear. His research was extended along these lines while from 1963 to 1965 he held an assistant professorship at M.I.T. as a Ford Foundation Postdoctoral Fellow. His final year, 1965-66, at M.I.T. was spent as a research associate. He holds membership in the American Association for the Advancement of Science, the Biophysical Society and the Acoustical Society of America. A native of Milwaukee, Wis., he did his undergraduate work at Purdue University, and won a National Science Foundation fellowship which he held from 1959 to 1961. . . . **Charles Freed**, S.M. '54, E.E. '58, is a staff member in the applied optics group at Lincoln Laboratory working with Dr. **Robert Kingston**, VI-A '47 and Ph.D. VIII. He has published several papers recently on intensity fluctuation measurements on laser light, both below and above the threshold of oscillation. He is currently working on the stability type of measurements including frequency-modulation noise. A native of Budapest, Hungary, he received the

B.E.E. degree at New York University in 1952. He and Mrs. Freed and their two daughters live on Browning Lane, Lincoln, Mass., and are frequently seen on Sundays at the M.I.T. Student Center and at the skating rink. . . . **Ralph C. Johnston**, S.M. E.E. '58, reports his marriage last June 18 to Miss Linda Sherman of Greenfield, Mass., an art student at the Boston Museum School. They reside at 96 Popular St., Watertown, Mass. Mr. Johnston is a staff member with the computer components group at Lincoln Laboratory, working with Dr. **Donald O. Smith** (VI S.B. '49, VI S.M., VIII Ph.D.) on instrumentation for physics experiments in magnetic films. He sang in the recent Chorus pro Musica—Boston Symphony production of Lohengrin and in the Boston Opera Company's production, *Moses and Aaron*. He received the B.S. degree in Electrical Engineering at Iowa State University in 1955. . . . The Board of Directors of IEEE has announced its 1966 list of members elevated to the grade of Fellow, effective January 1, 1967. Recognition of the awards will be made by the president of IEEE at the annual banquet March 22 during the International Convention in New York City. Of the M.I.T. graduate student category, the following with their citations are included: **Clarence J. Baldwin, Jr.**, E.E. '57, manager of advanced development, electric utility engineering, Westinghouse Electric Corporation, "for contributions to the planning of power generation, transmission and distribution systems"; **Robert W. Beatty**, S.M. '43, scientific consultant, National Bureau of Standards, "for contributions to microwave measurements and techniques"; **James M. Ham**, S.M. '47, Sc.D. '52, Dean of Engineering at the University of Toronto, "for leadership in engineering education and research, and for contributions to the field of automatic control systems"; **E. Calvin Johnson, Jr.**, S.M. '49, E.E. '50, Sc.D. '51, assistant general manager, Bendix Research Laboratories, Southfield, Mich., "for contributions to the field of control systems technology, numerically controlled machine tool systems, and automation." **Alan L. McWhorter**, Sc.D. '55, professor of electrical engineering, M.I.T. and head of solid state division, Lincoln Laboratory, "for outstanding contributions to the fundamental understanding of solid state electronic devices"; **Max T. Weiss**, S.M. '47 (VIII Ph.D.), general manager of laboratories division, Aerospace Corporation, "for contributions to microwave ferrites and in the management of research." . . . **Peter R. Metz**, S.M. '58, reports that he is assistant professor of electrical engineering at his alma mater, the University of Washington.—Professor **Karl L. Wildes**, Room 4-343, M.I.T., Cambridge, Mass. 02139

XVI

Your response to my recent letter indicates an overwhelming approval of identifying graduate-only alumni by course,



Eric G. Friberg,
XVI, S.M. '65

and many of you have sent me very interesting letters. There does seem to be some question as to just what kind of information is wanted. I suggest you consider this column to be like the bulletin board in a general store—a place for information about you or your Course XVI colleagues that would be of interest to each other. Our group has one small sector who have recently been making news and will continue to do so, five of the astronauts. **Dave Scott**, in Gemini VIII, where it was shown that a safe landing could be made even after severe malfunction of equipment in space and "Buzz" **Aldrin** in Gemini XII, whose performance materially extended our knowledge of extra-vehicular activities, have already been in space. Coming along soon are **Russ Schweikert**, **Ed Mitchell**, and **Charles Duke**. We are very proud of our astronaut colleagues. . . . A sad note from our charter member, Dr. **Hunsaker**, "We regret to report the death of Mrs. J. C. Hunsaker (Alice Avery). She had been in poor health for some time and passed away in her sleep in September 1966. She leaves four children and nine grandchildren. Mrs. Hunsaker, before her marriage in 1911, attended Farmington School and the School of the Museum of Fine Arts. She was a member of the Colonial Dames, Chilton Club, Sewing Circle, and the Beacon Hill Reading Club." . . . **Jerome Namias** is Chief, Extended Forecast Division, of the Weather Bureau; although meteorology is now considered an earth science, we fondly remember our meteorologist friends from past days. . . . **H. F. Lloyd** (Capt. U. S. N.) is now the commanding officer of the Naval Air Training Center at Memphis, having recently been the Deputy Superintendent of the Navy Postgraduate School. . . . We find **John Hovorka** is professor and head of the

John A. Schira, Jr., XVI, S.M. '62



Physics Department at Hobart and William Smith Colleges—how our group gets around after leaving M.I.T. . . . **Fred Dent** (Major General, USAF Ret.) has decided to live up to his Air Force title and now is pursuing the finer life in Florida. . . . In the greater Boston area we have **Sid Lees** as head of the Bioengineering Department of Forsyth Institute for Research and Advanced Study; **Al Ehrenfried** who is very busy at Technical Marketing Associates and Metritape Controls, the latter making equipment to measure the level of liquids and powders; and **Steve Levine** in a new research organization, the Analytic Sciences Corporation. . . . **Tom Harriman**, vice-president for corporation development of Giannini Controls, writes from New York that they, "with a double handful of M.I.T. graduates" are busy with data-processing, fluid controls, etc., for industrial and aerospace use.

Eric G. Friberg, S.M. '65, has been promoted to first lieutenant in the U.S. Air Force. He is a project engineer at Wright-Patterson A.F.B., Ohio, and is a member of the Office of Aerospace Research which is responsible for the total Air Force research program and certain parts of research programs of other government agencies. A graduate of the Frankfurt (Germany) High School, he received an A.B. degree in engineering in 1964 from Harvard and was commissioned there upon completion of the Air Force Reserve Officers Training Corps program. . . . U.S. Air Force Captain **John A. Schira, Jr.**, S.M. '62, helped boost astronauts Lovell and Aldrin safely into orbit for their four-day space flight. He is assigned to the Gemini launch vehicle division, Patrick A.F.B., Fla., and helped assure the safe and reliable operation of the Titan booster that hurled the spacecraft into orbit. A graduate of Solon High School, Ohio, Captain Schira received his B.S. degree and his commission in 1960 upon graduation from the U.S. Air Force Academy. . . . So many letters are coming in that it will be necessary to continue this column in the next issue of the Review.—Professor **Walter Wrigley**, Room ILS-419, M.I.T., Cambridge, Mass. 02139

Sloan Fellows

William G. Kay, Jr., '63, has been appointed president of the Rival Pet Foods Division of Associated Products, Inc., in Chicago. Most recently Mr. Kay was associated with Campbell Soup Company as vice-president in marketing of Pepperidge Farm, Inc., and as vice-president and general manager of the Frozen Food Division of Pepperidge Farm.

William S. Nochisaki, '60, changed his position effective the first of this year to become executive director of manufacturing with the Bell Aerospace Company in Buffalo, N.Y. He will be reporting to the vice-president of manufacturing, **Robert S. Ames**, '54. Mr. Nochisaki was formerly chief of manufacturing services with Sikorsky Aircraft, a division of United Aircraft Corporation.

Club News

Alumni Council:

Reviewing the Earth Sciences

A full evening of activity and entertainment greeted members of the Alumni Council at its 390th meeting on January 30. The principal speaker, Frank Press, head of the Department of Geology and Geophysics, described teaching and research in a number of fields in the earth sciences, including the study of the earth as a heat engine caused by internal radioactivity, high-pressure geophysics through which may be duplicated in the laboratory conditions presumed to exist in the earth's core, research into earthquakes and their prediction and into the detection of nuclear explosions, fossil magnetism as a new tool for studying the age and development of the earth, seismography on the lunar surface, planetary electricity and magnetism and the cosmic and atmospheric radiation areas, physical oceanography, and geochemistry. In his remarks and in response to questions, Dr. Press emphasized the importance of the increasing knowledge of the moon which is promised in the very near future by unmanned and manned lunar explorations.

The secretary reported the nominations for officers of the Alumni Association and term members of the Corporation which are listed elsewhere in this issue of the Review; the Executive Committee proposal of John J. Wilson, '29 (District 1) and endorsement of Edward J. Norris, '31 (District 2), James B. Neal, '15, and H. Sheldon Smith, '31 (District 3), and Rudolph J. Ozol, '36, and William H. Correale, '24 (District 5) for members of the National Nominating Committee; and the Executive Committee's action to recognize the Graduate Alumni Association of the Sloan School of Management, thus assuring representation for this group of about 1,000 alumni on the Alumni Council. (The G.A.A.'s first representative on the Council is Arthur P. Alexander, '58.)

Following the official business of the meeting, members of the Council viewed a motion picture of the inauguration of Howard W. Johnson by Oscar H. Horowitz, '22, which is now available for use by Alumni clubs throughout the country; and the NASA films of the Gemini 12 flight, including the extravehicular activity of Edwin E. ("Buzz") Aldrin, '63. The NASA film was narrated by Peter Gwynne, Acting Managing Editor of Technology Review, who prepared the Gemini report for the February issue.

M.I.T. Club of Delaware Valley:

Hosts President Howard W. Johnson

President and Mrs. Howard W. Johnson were the honored guests of the M.I.T. Club of Delaware Valley at the winter dinner meeting held at the Union League of Philadelphia on January 25, 1967. Approximately 250 alumni and wives attended the meeting at which President Johnson presented a most interesting address on the many changes taking place

at the Institute. Prior to the address Mr. Theodore A. Mangelsdorf, '26, President of the M.I.T. Alumni Association, presented to Mr. Donald F. Carpenter, '22, the award of the Bronze Beaver for his outstanding service to the Institute.

At a brief business meeting the following alumni were elected as officers of the Club for 1967: President, Gilbert P. Monet, '43; First Vice-president, Lee C. Eagleton, '44; Second Vice-president, John B. Murdock, '41; Third Vice-president, A. Rufus Applegarth, '35; Treasurer, Harold R. Spaans, '30; Secretary, Edward S. Halfmann, '36; Assistant Secretary, Jack A. Raymond, '58. The following were elected to the Executive Committee: Arthur D. Bertolett, '31; John S. O'Conor, '36; Rea W. Stanhouse, '41; George S. Saulnier, '47; John D. Fogarty, '49; Christian Schlemmer, Jr., '59; George A. Schnabel, '60.—Edward S. Halfmann, '36, 432 Parkview Drive, Wynnewood, Pa. 19096

M.I.T. Club of Western New York:

Dr. Killian to Visit April 10

The occasion of Dr. James R. Killian's April 10 visit to the Western New York area (Buffalo—Niagara Falls) will be our most important alumni event here in many years. The M.I.T. Club of Western New York and our area Educational Council have combined forces to sponsor a most inviting dinner program at Buffalo's spanking new Hearthstone Manor. Dr. Killian's program will be a fascinating presentation on modern teaching philosophies and techniques, "Innovation in Education." Our Dinner Committee plans not only to invite M.I.T. alumni, their husbands, wives and guests, but area science teachers, other educators, and interested individuals.

Current M.I.T. students in the Western New York area April 10 are also invited, and we certainly would be pleased if the parents of these students could be in attendance. Local alumni officers have planned a reception preceding the dinner and evening program to afford all guests an opportunity to visit with Dr. Killian and also view various enlightening ESI displays. Advance reservations for the April 10 event may be obtained by writing or calling Miss Joan Mathien, 438 Main Street, Buffalo, New York, 14202—telephone TL 6-2222.—Charles Diebold, III, Chairman, Killian Dinner Committee

M.I.T. Club of Southwest Florida:

Ladies Night in Sarasota

The M.I.T. Club of Southwest Florida held its annual Ladies Night on December 12, 1966, at Martine's on South Tamiami Trail, Sarasota. Col. and Mrs. Granville B. Smith, '18, related the "fun" and "frazzled" sides of their 1965 trip to Europe and showed pictures taken in Spain and North Africa. Attending: Joe and Mrs. Wattles, '08; Hardy Cook, '09 (Mrs. Cook was recovering from a virus); Sam and Mrs. Rogers, '13; Emory and Mrs. Kemp, '16 (Alumni Council Representative); Granville and Mrs. Smith, '18; Henry and Mrs. Nash, '20; "Bob" and Mrs. Robillard, '20 (Director); Jack and Mrs. Starkweather, '21; Ray and Mrs. Holden,



More than 600 Los Angelinos attended the M.I.T. Club of Southern California's dinner on January 17 to honor President and Mrs. Howard W. Johnson. The audience included several hundred alumni and their wives, representatives of Southern California industry, and a number of high school teachers and counselors. The pictures show Robert K. Wead, '36, secretary of the club, during his part of the annual business meeting which preceded President Johnson's address; and views of President Johnson greeting James H. Doolittle, '24, and the President and Mrs. Johnson with Mr. and Mrs. Ivan A. Getting ('33). The affair was arranged under the direction of Arthur Schwartz, '47, president of the club.

'23; Lowell and Mrs. Holmes, '23 (Secretary-Treasurer); Dave and Mrs. Joy, '23; G. G. and Mrs. Kearn, '24; "Ben" and Mrs. Groenewold, '25 (President); Nat and Mrs. Gada, '26; "Bill" Grunwell, '28 (Director) and Mrs. Van Cleave; Dave and Mrs. Eberly, '49 (Vice-president). Voted to draft "Bat" Thresher, '18, for a Special Ladies Night in January. ("Bat" was reported to be at Cocoa Beach taking the Sun Cure). "No Dice."—Lowell L. Holmes, '23, Secretary, P.O. Box 2271, Sarasota, Florida 33578

M.I.T. Club of Milwaukee: Picnic, Theatre, Christmas Luncheon

The Milwaukee M.I.T. Alumni Club activity last summer included two enjoyable events. One was a picnic at the home of Harold Koch at Pewaukee Lake, Wis., about 20 miles west of Milwaukee. The weather was lovely, and we all enjoyed swimming, boating, lawn games and a sumptuous catered outdoor buffet dinner. We had a good turnout (about 60) including a number of children and M.I.T. students. The other event was a delightful theatre party of 20 alumni and wives at the Sunset Playhouse in Elm Grove, Wis., to see the presentation of the musical play *Oklahoma*. After the theatre we went to the Black Steer restaurant for a late snack.

The Club held an annual Christmas luncheon on December 27th at the Milwaukee University Club for M.I.T. students residing in the Milwaukee area. This event was attended by M.I.T. alumni, students and fathers of the students. Out of 27 students in the Milwaukee area, 16 students including one coed, Miss Joan Etzweiler, were in attendance. Brief talks were given by students Edward and Fred Gruhl on current Institute life. Some of the interesting facts mentioned were: so much construction going up on campus now that parking facilities are fast disappearing and top level Institute meetings are being held to solve faculty parking problems (no parking facilities available to students); out of about 3600 undergraduates, 160 are women students; at present there are the same number of graduate students as there are undergraduates, and within the next few years there will be more graduate students than undergrads; such a large number of M.I.T. alumni are enrolled in the Harvard Graduate School that there is now an M.I.T. alumni club at Harvard. Another highlight of this Christmas luncheon meeting was the citation and presentation of a certificate of achievement to William H. Schield, Jr., '46, for attaining an outstanding record in directing the 1966 Alumni Fund Drive in the Milwaukee area. Total receipts for the Institute for the 1966 Alumni Fund were \$2,210,356 with 16,272 alumni contributing. M.I.T. students attending the luncheon were: Miss Joan Etzweiler, Richard Boettger, William Carson, Richard Edelman, John Fricker, Edward Gruhl, Fred Gruhl, James Gruhl, Michael Meloy, David Mountain, George Nielsen, Jr., Michael Toon, James Totten, Glen Wanek, Robert Wachbroit, and Ron Zelazo.—Martin M. Kuban, '37, Secretary, 7343 Milwaukee Ave., Milwaukee, Wis. 53213

M.I.T. Club of Chicago: Lunar Soil and Soft Moon Landings

Professor T. William Lambe presented a fascinating discussion of lunar soil mechanics to the M.I.T. Club of Chicago on January 18. Using excellent slides, including many recent N.A.S.A. space probe photographs, Professor Lambe described in detail the studies of the moon's surface. He discussed the several leading theories concerning the composition of lunar soil. He concluded that only actual sampling and testing by astronaut explorers would provide firm answers. Professor Lambe believed the risks of a soft landing by astronauts have been reduced to an acceptable level. Data and photos from Surveyor I have provided enough information to give reasonable assurance of a successful landing and return by a space vehicle. He supported the enormous commitment to the N.A.S.A. moon program by our country. He felt a variety of reasons, such as the challenge of pure exploration, opportunity to advance technology, stimulation of a national goal, and the effect on our world position justified this multi-billion dollar program. A large group of alumni, wives, and guests found this to be one of our best dinner meetings.

Further meetings for the Chicago Club will include a discussion of Biomedical Engineering in March, and a theater party in April. For our annual meeting in May, we will be privileged to have Dean William F. Pounds of the Sloan School of Management.

M.I.T. Club of Washington: March 9, HUD; April 25, UFO's

At the March 9 dinner meeting to be held at the Cosmos Club, the M.I.T. Club of Washington will be honored to have as guest speaker, Mr. Robert C. Wood, Under Secretary of the Department of Housing and Urban Development (HUD). Most recently Mr. Wood was an M.I.T. professor and chairman of the M.I.T.-Harvard Joint Center for Urban Studies. The meeting should be of great interest to all area alumni.

Our program for April 25 has already aroused considerable interest in Washington. We will present a well-known scientist whose identity will be announced in the near future to offer a rational discourse on the subject of UFO's. New physical theories will be discussed that tend to explain some of the observed phenomena.

A seminar on "New Concepts in Management" was held on February 18 in Washington at the Institute for Defense Analyses Building. In terms of alumni participation and program content the seminar was an overwhelming success. The opening address was made by General Maxwell Taylor, the president of IDA. General Taylor was followed by the principal speakers, all of the M.I.T. Sloan School of Management, Dean William F. Pounds, Professor Zenon Zannatos and Professor Warren G. Bennis. The seminar concluded with a panel discussion and a round of questions from the floor. Its success ensures a continuation of effort next year on another subject of interest.—Dan R. McConnell, '61, 4134A Suitland Road, Suitland, Md. 20023

Club Calendar

March

DALLAS—Dinner at the S.M.U. Student Center, March 7—Jerome B. Wiesner, M.I.T. Provost.

WASHINGTON, D.C.—Dinner meeting, March 9.

MEXICO CITY—19th annual M.I.T. Fiesta, March 9 to 11—Jerome B. Wiesner, M.I.T. Provost, at the University Club.

BOSTON—Luncheon at the Union Oyster House, March 9—Owen B. Kieran, Massachusetts Commissioner of Education.

NEWARK—Dinner at the Neptune Inn, Paramus, March 14—Robert Kroeger, Sperry-Rand Corp.

HOUSTON—Dinner at the Nassau Bay Holiday Inn, March 28—Halsey C. Herreshoff, '60, M.I.T. Department of Naval Architecture and Marine Engineering.

April

NEW YORK CITY—Buffet dinner at the Harvard Club (joint meeting), April 5

—Jerrold R. Zacharias and Philip Morrison, M.I.T. Department of Physics.

BUFFALO—Dinner at Hearthstone Manor, April 10—James R. Killian, Jr., '62, Chairman of the M.I.T. Corporation.

CLEVELAND—Dinner at the University Club, March 13—Lucian W. Pye, M.I.T. Department of Political Science.

BOSTON—Dinner at the M.I.T. Faculty Club, April 13—Howard W. Johnson, M.I.T. President.

ROCHESTER—Dinner, April 18—William F. Pounds, Dean of the M.I.T. Sloan School of Management.

SAN FRANCISCO—Dinner at the Engineers' Club, April 20—Howard W. Johnson, M.I.T. President.

SYRACUSE—Dinner (jointly with the Technology Club of Syracuse), April 24—James F. Killian, Jr., '26, Chairman of the M.I.T. Corporation.

WASHINGTON, D.C.—Dinner, April 25—Robert C. Wood, Under Secretary of the Department of Housing and Urban Development.

May

MANCHESTER, N.H.—Dinner, May 3—Paul E. Gray, '54, Associate Dean of Student Affairs, M.I.T., and Alan J. Lazarus, '53, M.I.T. Department of Physics.

NEW YORK CITY—Buffet dinner at the Harvard Club (joint meeting), May 3

—Francis Keppel, General Learning Corporation.

CHICAGO—Dinner, May 16—William F. Pounds, Dean, and E. P. Brooks, '17, Dean Emeritus of the M.I.T. Sloan School of Management.



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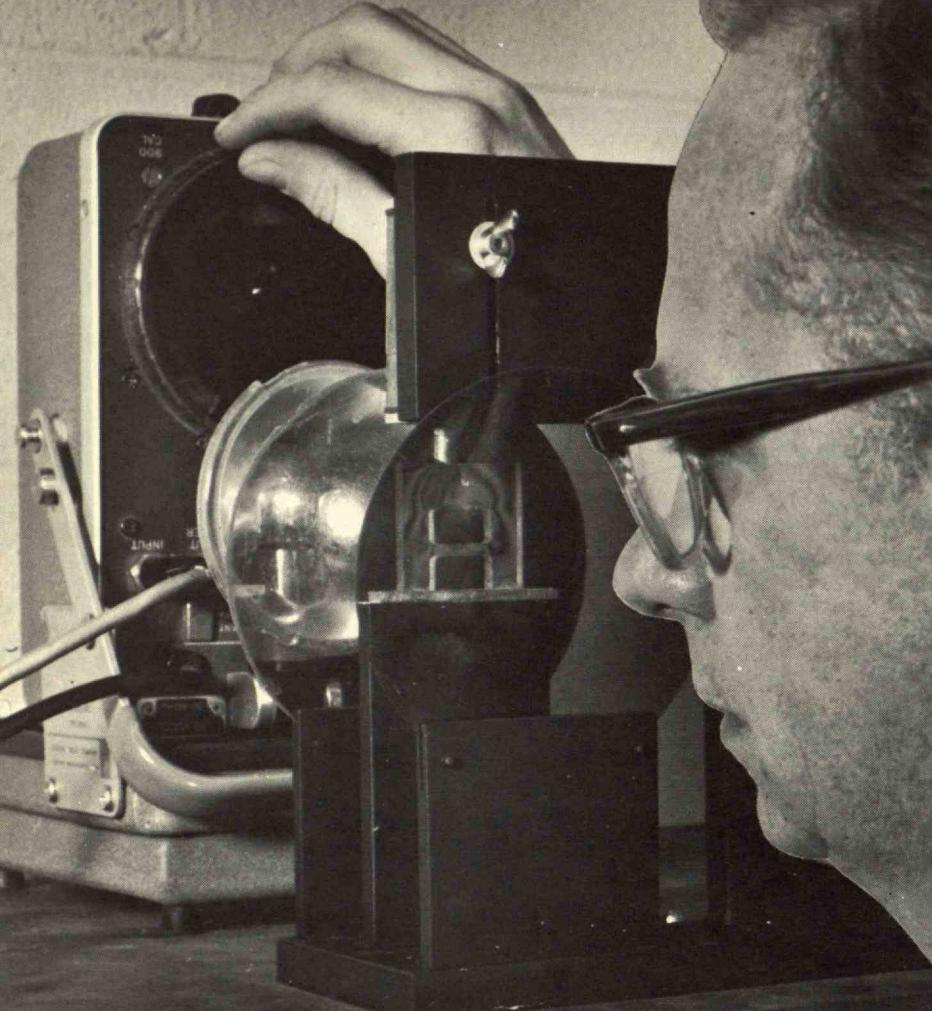


Photo courtesy Allied Research Associates, Inc., Concord, Mass.

An inside look at stress

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